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Introduction

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Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **3713**

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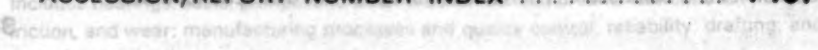
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TITLE
EXPERIMENTS ON VISUAL ACUITY AND THE VISIBILITY OF MARKINGS ON THE GROUND IN LONG-DURATION EARTH-ORBITAL SPACE FLIGHT
AUTHOR
S. Q. Duntley, R. W. Austin, J. L. Harris, and J. H. Taylor
PUBLICATION DATE
Washington NASA Nov. 1968 231 p refs
CONTRACT OR GRANT
(Contract NAS9-5095)
AVAILABILITY SOURCE
NASA-CR-1134; SIO-Ref-68-6) Avail: CFSTI CSCL 06S
REPORT NUMBER
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Visual acuity experiments conducted during the Gemini program are discussed. The report sets forth the evolution of the experimental design, the preparatory experiments, the equipments constructed, the training of flight crews and teams of experimenters, the selection of ground sites, their preparation and operation, the inflight experiments on Gemini 5 and Gemini 7, the resulting data and their interpretation, the conclusions and their meaning in terms of the Apollo mission and other future spaceflights, as well as certain suggestions for future inflight tests of human visual capabilities in space.
Author

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Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N69-34651# Royal Aircraft Establishment, Farnborough (England). Structures Dept.

THE FORMULATION OF AN INFLUENCE-COEFFICIENT METHOD FOR DETERMINING STATIC AEROELASTIC EFFECTS, AND ITS APPLICATION TO A SLENDER AIRCRAFT IN SYMMETRIC FLIGHT AT M = 2.2

A. S. Taylor and D. J. Eckford London HMSO 1969 52 p refs Supersedes RAE-TR-67237; ARC-30059; See N68-27749 (ARC-R/M-3573; RAE-TR-67237; ARC-30059) Copyright. Avail: HMSO, London: £1 2s 6d

This report presents a matrix formulation of a method which employs influence coefficients to solve static aeroelastic problems. Linear structural characteristics are assumed and the aerodynamic loading, including that due to elastic deformation, is assumed to be compounded from a linear combination of 'elementary' distributions. Details of the method are here considered only for symmetric flight cases, though in essence it is universally applicable. The method has been applied to a 'Concorde'-like supersonic transport aircraft in symmetric flight at M = 2.2. Linearised supersonic theory has been used to derive the load due to elastic deformation. Results are presented for the incidences and elevator angles to trim and to sustain quasi-steady manoeuvres, for the longitudinal distributions of shear force and bending moment, and for the elastic deformation acquired. The potentialities of the method are considered sufficient to justify the expenditure of the further effort which is necessary to develop it into a fully automated design procedure of wide applicability. Author (ESRO)

N69-34678# Politecnico di Torino (Italy). Istituto di Macchine e Motori per Aeromobili.

RESEARCH ABOUT THE SHOCK WAVE STABILITY IN A SUPERSONIC AIR-INLET [RICERCHE SULLA STABILITA DELL'ONDA D'URTO ENTRO UNA PRESA DINAMICA SUPERSONICA]

L. Verduzio Sep. 1967 32 p refs In ITALIAN; ENGLISH summary (Contract CNR-115/0375/200) (Publ-87) Avail: CFSTI

This paper investigates the working stability of those supersonic air-inlets, where a normal shock wave occurs inside the diffuser, in order to obtain a method to forecast their performance field and to obtain information useful to design the diffuser divergent part, and enlarge this field as much as possible. After a short summary of the method proposed by Hurrell to study the shock wave motion, some particular cases of the downstream pressure variation, which most probably occurs in an air-inlet coupled with an aeronautical propulsor, are considered. In order to verify the reliability of the calculations many experimental tests have been made, using a special equipment made in the Laboratories of the Istituto di Macchine e Motori per Aeromobili of the Politecnico di Torino. With such equipment, the shock wave displacement, because of damping sinusoidal variation in time of the downstream pressure, has been measured. The experimental results are qualitatively in a very good agreement with the theory, while the values of the maximum measured displacement are always bigger than the theoretical ones (30% maximum difference). The proposed study method seems to be very useful to forecast the air-inlet performance field, even if the obtained results shall be corrected to consider the differences realized during experiments. From this study the best air-inlet geometry both with regard to the total pressure recovery and to performance stability can be deduced. Author (ESRO)

N69-34680# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

SOLUTION BY ASYMPTOTIC EXPANSIONS OF THE DAMPED WAVE EQUATION. APPLICATION TO THE CALCULATION OF STEADY AND UNSTEADY SUPERSONIC FLOWS [RESOLUTION, PAR DEVELOPPEMENTS ASYMPTOTIQUES, DE L'EQUATION DES ONDES AMORTIES. APPLICATION AU CALCUL D'ECOULEMENTS SUPERSONIQUES STATIONNAIRES ET INSTATIONNAIRES]

Maurice Fenain 1968 111 p refs In FRENCH; ENGLISH summary (ONERA-P-123) Avail: CFSTI

The linear damped wave equation which governs, in first approximation, supersonic flows past harmonically vibrating wings, totally inside the apex Mach cone, is solved by asymptotic expansions. The steady motion is considered as a particular case where the circular frequency is zero. Considered are problems in which the boundary values concern the law of deformation or the shape of the wing (direct problems) as well as problems in which the data concern the perturbation potential (inverse problems). The solution, of iterative type, in which the first step corresponds to the slender body theory, is reduced to the determination of interdependant harmonic and polyharmonic functions. A technique is developed which eliminates any indetermination and ensures minimization of the singularities as well as uniformization of the solutions. The expanded solutions, if not complete, may be known with as many terms as desired, the successive steps calling upon a systematic process. Among the examples presented some are treated numerically so that the practical interest of the present technique may be judged. Author

N69-34703*# Northrop Corp., Hawthorne, Calif.
RECIRCULATION EFFECTS PRODUCED BY A PAIR OF HEATED JETS IMPINGING ON A GROUND PLANE
Gordon R. Hall and Kenneth H. Rogers Washington NASA May 1969 115 p refs
(Contract NAS1-7834)
(NASA-CR-1307) Avail: CFSTI CSCL 01A

An experimental investigation of the recirculation effects resulting from the interaction of a pair of heated jets, a quiescent environment, a ground plane, and a pair of inlets was performed. Upwash blockage surfaces were also used for selected tests. Inlet temperature rise and upwash flow characteristics were determined for a wide range of model geometries and inlet/nozzle flow conditions. Details of the near flow field structure were obtained. Inlet temperature rise and induced aerodynamic forces have been related to the character of the near flow field. The results of the investigation lead to several significant conclusions which relate directly to model simulation of full scale recirculation phenomena. Author

N69-34705*# California Univ., Santa Barbara. Dept. of Mechanical Engineering.
THE SUPERSONIC FLIGHT OF A BLUNT BODY IN A DISTURBED ATMOSPHERE
Jose Evangelio Chirivella (Ph.D. Thesis) Jun. 1969 110 p refs
(Grant NGR-05-010-028)
(NASA-CR-66822) Avail: CFSTI CSCL 01A

The method of integral relations has been applied to determine the field properties in the subsonic and transonic regions of the flow about a blunt axisymmetric body. The conditions in the free stream are assumed to have sharp gradients of the Mach number and/or stagnation temperature in the direction perpendicular to the free flow. The stagnation pressure is kept constant. Four cases were run: case 1 where the case for uniform free stream is solved and compared with available solutions encountered in the literature; case 2 where the Mach number varies in the radial direction; case 3 where the Mach number remains constant but the stagnation temperature is allowed to vary across the oncoming flow; and case 4 corresponds to a simultaneous variation of the Mach number and the stagnation temperature. It is found that the most sensitive parameter to the nonuniformities is the sonic point on the body, and a general discussion and examination of the other flow parameters is carried out. Author

N69-34888# Sandia Corp., Albuquerque, N. Mex.
BASE IMPELLERS FOR ROLL CONTROL OF REENTRY VEHICLES
M. D. Bennett and Amado A. Trujillo Jan. 1969 16 p refs
(SC-RR-69-13; PB-183112) Avail: CFSTI CSCL 16D

A roll-control concept is considered for ballistic reentry vehicles that have small, but not negligible, configurational asymmetries. The control system consists of a number of blades or fins attached to the base of the vehicle in a manner to form an impeller that is integral with the body. Three impeller configurations were evaluated aerodynamically on a conical body in exploratory wind-tunnel tests at hypersonic speed, and the results are correlated with a generalized fin parameter. A simple criterion is derived for the magnitude of the control moment required to prevent steady roll resonance at small angles of attack. It is shown that the maximum moment produced by these impeller designs is sufficiently large to prevent resonance on small conical reentry vehicles. Author (USGRDR)

N69-34986*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC CHARACTERISTICS IN PITCH OF A 1/7-SCALE MODEL OF A TWO- AND THREE-STAGE ROCKET CONFIGURATION AT MACH NUMBERS OF 0.4 TO 4.63
William F. Hinson, Richard A. Langhans, and Roger H. Fournier Washington Aug. 1969 40 p refs
(NASA-TM-D-5378) Avail: CFSTI CSCL 01A

An investigation has been conducted to determine the longitudinal stability characteristics of the upper two- and three-stage combinations of a four-stage solid-propellant unguided rocket research vehicle. The stages tested were stabilized by trapezoidal cruciform fins. Test Mach number range for the three-stage configuration was 0.4 to 1.0; for the two-stage configuration, 0.4 to 4.63. Angle-of-attack range was approximately -4^0 to 14^0. Reynolds number ranged from 1.5×10^6 to 3.4×10^6 per foot (4.92×10^6 to 11.14×10^6 per meter). The general aerodynamic characteristics of normal-force, pitching-moment, and drag coefficients as a function of angle of attack and Mach number are presented. Author

N69-35154# Lockheed Missiles and Space Co., Sunnyvale, Calif.
SYSTEMATIC EXPERIMENTAL RESULTS ON THE DRAG OF POINTED AND BLUNT CONES AT HYPERSONIC SPEEDS
A. P. Krasil'Shchikov et al [1968] 3 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhan. Zhidk. i Gaza (USSR), no. 3, 1969 p 190–192
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Results are presented on systematic hypersonic tests of circular, pointed, and blunt sphere-cones. Data are obtained on drag coefficients in the form of parametric grids for the cone half-angle and the span at Mach numbers between 8 and 14. The numbers were in the order of $7\text{-}12 \times 10^6$, i.e., corresponding to flow domains when the effect of viscous interaction could be neglected. Results were compared with theoretical computations and experimental data. Author

N69-35300*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL PRESSURE DISTRIBUTIONS FOR A FAMILY OF BLUNT BODIES AT MACH NUMBERS FROM 2.49 TO 4.63 AND ANGLES OF ATTACK FROM 0 DEG TO 15 DEG
Robert L. Stallings, Jr. and Dorothy T. Howell Washington Aug. 1969 87 p refs
(NASA-TN-D-5392) Avail: CFSTI CSCL 01A

A family of blunt bodies of revolution having variable nose and shoulder radii and cylindrical afterbodies were tested ranging in shape from a hemisphere cylinder to a flat face cylinder. Included is a complete tabulation of the experimental data and a discussion of the more significant findings. Author

N69-35330# Telespazio, S.P.A., Rome (Italy).
THE FUCINO PLANT FOR THE TELEMETRY AND TELECONTROL OF INTELSAT SATELLITES
Giuseppe Quaglione 5 May 1969 35 p refs Presented at the 9th Brit. Interplanet. Soc. European Space Symp., London, 14–16 May 1969
Avail: CFSTI

The Fucino (Italy) tracking and command station is part of the ground network for Intelsat satellites. The equipment of the station including antennas, autotracking system, programmed tracking system, range measurement system, telemetry and telecommand subsystems and data transmission systems and their characteristics are described and discussed. ESRO

N69-35371*# Israel Program for Scientific Translations, Ltd., Jerusalem.
NONEQUILIBRIUM EXPANSION OF AIR IN SUPERSONIC NOZZLES

G. N. Nikolaev and V. P. Popov *In its* High-Temp. Properties of Gases. Phys. Gas Dyn., Thermodyn. and Phys. of Combust. 1969 p 51–58 refs (See N69-35365 20-12)
Copyright. Avail: CFSTI CSCL 01A

Air expansion in supersonic nozzles was studied by determining the Mach number from the angle of inclination of the weak disturbance propagating in the supersonic flow. Disturbances were recorded optically and Mach number values were compared by plotting curves calculated as functions of nozzle area and equilibrium air expansion. Physicochemical transformations at rapid expansion were described by a systems of equations including the kinetic equations of the chemical reactions involved. For temperatures up to 6000° air, the above described model of physicochemical transformations satisfied rapid expansions and calculated Mach numbers. Comparison of experimental data with these curves established the sharp slowdown if oxygen recombination at the nozzle section area was equal to 3 to 7 times the throat area.
G.G.

N69-35441# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
AN EXPERIMENTAL INVESTIGATION OF THE EFFECT OF PLANFORM SHAPE ON THE SUBSONIC LONGITUDINAL STABILITY CHARACTERISTICS OF SLENDER WINGS
D. A. Kirby Aeronautical Res. Council 1969 87 p refs Supersedes RAE-TR-67142; ARC-29736
(ARC-R/M-3568; RAE-TR-67-142; ARC-29736 Copyright. Avail: CFSTI; HMSO: £1 17s 6d

Measurements of the lift, drag and pitching moment have been made on fifteen symmetrical slender wing models in the aspect ratio range 0.77 to 1.4 and the results analysed to find the effect of planform shape by identifying the influence of several geometric parameters on the longitudinal stability characteristics. All the wings were sharp-edged and had a maximum thickness/chord ratio of 4 per cent. The results show that by splitting the normal force on each wing into a linear component, which is associated with the attached flow assumed to occur in slender-wing theory, and a non-linear component, associated with the effects of flow separation at the leading edge, an understanding of the factors which influence the lift and pitching moment can be obtained, and curves derived which may be used to predict the behaviour of other similar wings. In addition empirical curves for predicting the aerodynamic-centre position directly are presented. Other aspects such as the effect of adding a symmetrical body and of changing the trailing-edge sweep are discussed briefly. A short analysis of the lift-dependent drag is also included. Author (ESRO)

N69-35445# National Physical Lab., Teddington (England). Aerodynamics Div.
THE AERODYNAMIC INVESTIGATION OF A GAS-TURBINE EXHAUST TOWER FOR ABERTHAW 'B' GENERATING STATION
D. E. Walshe Jan. 1969 18 p refs
(NPL-AERO-SR-019) Copyright Avail: CFSTI

The aerodynamic stability of a three-flue stack supported by a lattice-framework tower was determined from the results of dynamic tests carried out on a linear-mode model mounted in a wind tunnel. It was found that instability occurred at very high wind speeds over limited ranges of wind inclination in the horizontal plane and was readily damped to small amplitudes. The excitation was associated with vortex shedding from the sides of the flue combination rather than from individual ducts. Author (ESRO)

N69-35461# National Physical Lab., Teddington (England). Aerodynamics Div.
AN AERODYNAMIC INVESTIGATION OF MODELS OF THE FOUR IN-LINE 660ft STACKS PROPOSED FOR THE PIGEON HOUSE 'B' GENERATING STATION, DUBLIN
R. E. Whitbread Feb. 1969 44 p refs
(NPL-AERO-SR-021) Copyright. Avail: CFSTI

Wind-induced amplitudes of oscillation were measured on flexibly-mounted linear-mode models for both smooth uniform wind and for wind with a spectrum of turbulence representative of that anticipated at 680ft over Dublin. Initially the response of a single Pigeon House 'B' stack was compared with that of both a cylindrical model and a model of an existing stack with a more pronounced taper than that proposed for Pigeon House 'B'. The main part of the programme consisted of tests with two, three and four stacks in-line for structural damping values of 0.5% and 1% critical and for the range of wind direction from 0° to 25° off the line of the stacks. Author (ESRO)

N69-35501# National Physical Lab., Teddington (England). Aerodynamics Div.
CALCULATION OF BOUNDARY-LAYER DEVELOPMENT USING THE TURBULENT ENERGY EQUATION. PART 5: WAKES NEAR A TRAILING EDGE
P. Bradshaw 30 Jan. 1969 17 p refs
(NPL-AERO-1285) Copyright Avail: CFSTI

The basic calculation method is extended to the (symmetrical) aerofoil wake, close enough to the trailing edge for the effects of the change in boundary condition to be confined to the inner layer of the shear layer (Y/δ X87 0.2); in practice this means x $qX86Z$ | 7δ approximately, which is enough for displacement surface calculations since the errors that appear at larger distances downstream are not gross. Author (ESRO)

N69-35521*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
AERODYNAMIC EFFECTS OF BULBOUS BASES
Lars E. Ericsson and J. Peter Reding Washington NASA Aug. 1969 116 p refs
(Contract NAS1-6450)
(NASA-CR-1339; LMSC-4-17-68-4) Avail: CFSTI CSCL 01A

An exploratory study has been made of the effect that a bulbous base can have on the aerodynamic characteristics of blunt space capsules and slender reentry bodies. It is found that the base has a profound effect and can cause drastic loss of dynamic stability. A careful examination of available experimental data reveals that the often complex effects of bulbous bases can be explained using quasi-steady separated flow concepts. In general, a bulbous base adversely affects the vehicle dynamics but increases the static stability. Support interference is a serious problem that can prevent simulation in dynamic wind tunnel tests of full-scale vehicle dynamics. A possible means of measuring and correcting for this dynamic sting interference is outlined. Author

N69-35625*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
SURVEY OF WORK PERFORMED AT THE MOSCOW UNIVERSITY DEALING WITH NUMERICAL INVESTIGATION OF EXTERNAL AND INTERNAL PROBLEMS IN AERODYNAMICS [OBZOR RABOT PO CHISLENNOMU ISSLEDOVANIYU VNESHNIKH I VNUTRENNIKH ZADACH AERODINAMIKI, VYPOLNENYKH V MOSKOVSKOM UNIVERSITETE]
G. S. Roslyakov et al Washington NASA Aug. 1969 25 p refs Transl. into ENGLISH from Computer Methods and Programming, Numerical Methods in Gasdyn., Collection of Works (Moscow), no. 11, p 93–112
(Contract NASw-1692)
(NASA-TT-F-12445) Avail: CFSTI CSCL 01A

This is a survey of research performed at the Moscow University Computer Center between 1963 and 1967 dealing with

a numerical investigation of problems in aerodynamics, namely: stationary gas flows in nozzles and jets; supersonic flow around pointed bodies; supersonic flow around blunt bodies; certain theoretical problems related to solution of an improper cauchy problem; and nonstationary gas flows in tubes. Author

N69-35872*# National Aeronautics and Space Administration, Washington, D.C.
RESEARCH ON LOW-DRAG TRANSONIC PROFILES [RECHERCHES SUR DES PROFILS TRANSSONIQUES DE FAIBLE TRAINEE]
Vincent de Paul Aug. 1969 33 p refs Transl. into ENGLISH from French Presented at the 4th Meeting of Appl. Dyn., Lille, 8–10 Nov. 1967 Revised
(NASA-TT-F-12171-Rev) Avail: CFSTI CSCL 01A

The results of work on the calculation and improvement of wing profiles in transonic flow are discussed. A practical method of determining the drag rise Mach number (the Mach number at which point the drag begins to increase because of the shocks), based on the criterion of the crest shock, is reviewed. The development of the supersonic zone is then analyzed by the method of characteristics for profiles which have an overspeed peak near the leading edge. It is shown how it is possible to obtain a profile giving supersonic recompression without shock, or at least ending with a weak shock, by local modifications of the upper surface. This method is illustrated by several examples. Author

N69-35821# Politecnico di Torino (Italy). Istituto di Macchine e Motori per Aeromobili.
FORECAST OF GROUND PERFORMANCES OF A SUPERSONIC AIR-INLET WITH PERFORATED WALLS, AND EXPERIMENTAL TESTS [PREVISIONE DELLE PRESTAZIONI DI UNA PRESA DINAMICA SUPERSONICA A PARETI PERFORATE A PUNTO FISSO, E VERIFICHE SPERIMENTALI]
L. Verduzio Sep. 1967 24 p refs In ITALIAN; ENGLISH summary Presented at Natl. AIDA-Air Congr., Milan, 5–8 Oct. 1967 Sponsored by Consiglio Nazl. Delle Ric.
(Publ-88) Avail: CFSTI

This study has been made to deduce in a theoretical way, the performances in subsonic field of a convergent-divergent air-inlet with perforations fitted in the walls of the convergent. The results are experimentally verified, in order to obtain information about the reliability of the theoretical evaluations. The tests have been limited to the determination of ground diffuser performances, since the obtained results have been considered as sufficiently representative of the precision which can be obtained with the used forecast methods. This study has the purpose to point out the penalties to be paid in the subsonic field in order to improve, at supersonic speed, the performances of an internal compression air-inlet. Author (ESRO)

N69-35826# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.
TESTS AT SUBSONIC AND SUPERSONIC SPEEDS ON A SLENDER CAMBERED WING WITH FIN, UNDERWING ENGINE NACELLES AND TRAILING-EDGE CONTROLS
D. Isaacs Aeronautical Res. Council 1969 57 p refs Supersedes RAE-TR-67-217; ARC-30070
(ARC-R/M-3593; RAE-TR-67-217; ARC-30070) Copyright. Avail: CFSTI; HMSO: £1 4s 6d

The tests were made in the 8 ft x 8 ft wind tunnel at RAE Bedford on a 1/36 scale model of a possible design for a supersonic transport aircraft. The wing camber was designed, using slender-wing theory, to have attached flow at a C_L of 0.02, and a shift forward of the centre of pressure, relative to the uncambered wing, of 0.3 c at C_L = 0.1. The present investigation was restricted to determining the effects of the fin and nacelles on the longitudinal stability, drag, and lateral stability of the wing and to measurements of effectiveness, drag, and hinge moment of the controls. Author (ESRO)

N69-35855*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Hampton, Va.
PRESSURES AND HEAT TRANSFER ON A 75 DEGREE SWEPT DELTA WING WITH TRAILING-EDGE FLAP AT MACH 8 AND ANGLES OF ATTACK TO 90 DEGREES
J. Wayne Keyes Washington Sep. 1969 46 p refs
(NASA-TN-D-5418) Avail: CFSTI CSCL 01A

An investigation has been made of the effects of deflecting a flap on the flow field on a 75° swept delta wing with sealed gap for angles of attack from 0° to 90°. Pressure and heat-transfer measurements were made with the free-stream Reynolds number (based on wing root chord) varying from 1.3×10^6 to 5.6×10^6 for 0° angle of attack and at 3.4×10^6 for angles greater than 0°. Flap deflections from 0° to 40° were investigated. In general, center line calculations based on existing two-dimensional methods were in good agreement with the trends of the pressure and heat-transfer distributions if the flow pattern characteristic of the angle-of-attack range and the type of boundary layer are taken into account. Author

N69-35907# Stanford Univ., Calif. Dept. of Applied Mechanics.
COMPUTATION OF THE LAMINAR COMPRESSIBLE BOUNDARY LAYER Final Report, 15 Jun. 1964–15 Jun. 1969
Irmgard Fluegge-Lotz 15 Jun. 1969 17 p refs
(Contract AF 49(638)-1385)
(AD-688888; AFOSR-69-1404TR) Avail: CSFTI CSCL 20/4

The report contains abstracts of significant research papers developed on the laminar compressible boundary layer in the stagnation-point region for an axisymmetric blunt body, second-order boundary layer effects in hypersonic flow past axisymmetric blunt bodies, two-dimensional hypersonic stagnation flow at low Reynolds numbers, and a numerical solution for the laminar wake behind a finite flat plate. Author (TAB)

N69-35953# National Physical Lab., Teddington (England). Aerodynamics Div.
THE AERODYNAMIC INVESTIGATION FOR THE SUSPENDED STRUCTURE OF THE PROPOSED BOSPORUS BRIDGE
D. E. Walshe Jan. 1969 29 p refs
(NPL-AERO-SR-020) Copyright Avail: CFSTI

The sectional model method was used to determine the aerodynamic stability characteristics of a plated-box and of a truss-stiffened type of suspended structure. Instabilities with single-degree-of-freedom-motion were observed in up winds on both types of structure; the instability of the truss-type structure was the more severe. Both structures were subject to classical flutter instability but at high wind speeds. Measurements were also made of the static wind forces on the model of the truss-stiffened design. Author (ESRO)

N69-35960# Oxford Univ. (England). Dept. of Engineering Science.
SOME ASPECTS OF FLUID FLOW IN DUCTS
A. J. Ward Smith (Ph.D. Thesis) May 1968 328 p refs Sponsored by Roy. Aeron. Soc.
(REPT-1-066-68) Avail: CFSTI

The incompressible steady single-phase flow of perfect gases through piping systems of varying geometry is discussed from a

fundamental point of view to determine flow characteristics and pressure losses, in particular in bends, to increase efficiency in internal flow systems. ESRO

N69-35980# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Porz (West Germany). Institut fuer Angewandte Gasdynamik.
A PLANE PLATE IN LOW DENSITY HYPERSONIC FLOW [DIE EBENE PLATTE IN HYPERSONISCHER STROEMUNG GERINGER DICHTE]
Manfred Becker *In its* DVL News, No. 39 Mar. 1969 p 448–449 In GERMAN (See N69-35976 20-34)
Avail: CFSTI

Some problems connected with the reentry of spacecraft into the atmosphere or the gliding at high altitudes are not yet solved. Some aerodynamic problems are discussed which are halfway between continuum flow and free molecular flow. Plasma jet wind tunnel experiments are also described. ESRO

N69-35981# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Aachen (West Germany). Institut fuer Theoretische Gasdynamik.
THREE DIMENSIONAL SUPERSONIC FLOW ABOUT FINITE SPAN WINGS [DREIDIMENSIONALE UEBERSCHALLSTROEMUNG UM FLUEGEL ENDLICHER SPANNWEITE]
Anneliese Frohn and Yi-Chuin Sun *In its* DVL News, No. 39 Mar. 1969 p 450–453 In GERMAN (See N69-35976 20-34)
Avail: CFSTI

The three dimensional flow about wings of finite span differs largely from the flow existing around a wing with a very large span or a slender body, respectively. Problems connected with this deviation are treated theoretically for various wing profiles and geometries. ESRO

N69-35989# Aeronautical Research Council (Gt. Brit.)
THEORY OF LIFTING SURFACES OSCILLATING AT GENERAL FREQUENCIES IN A SUBSONIC STREAM
W. E. A. Acum 1969 48 p refs Supersedes ARC-17824; ARC-18630; ARC-19229; ARC-20771; See X65-80103 (ARC-R/M-3557; ARC-17824; ARC-18630; ARC-19229; ARC-20771) Copyright. Avail: CFSTI; HMSO: London: £1 1s

This report gives a description of an extension to wings oscillating at general frequencies of Multhopp's lifting-surface theory for wings in steady subsonic flow. This particular variant of the 'kernel function' method is published here because it has been used for many years in Aerodynamics Division, NPL, and has been the method to provide results in a number of papers already published. Author (ESRO)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N69-34713# Dornier-Werke G.m.b.H., Munich (West Germany).
DORNIER-POST, NO. 2-3, 1968
[1969] 46 p
Avail: CFSTI

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N69-34716# Dornier-Werke G.m.b.H., Munich (West Germany).
BEATING THE VTOL NOISE PROBLEM
R. Scholten and M. Flemming *In its* Dornier-Post, No. 2–3, 1968 [1969] p 20–23 (See N69-34713 20-02)
Avail: CFSTI

The noise levels generated by the DO 31 V/STOL aircraft are compared to those generated by other commercial aircraft, considering both engines with and without noise reducing equipment. It is concluded that V/STOL aircraft noise is comparable to or less than that caused by ordinary aircraft, not considering shorter landing and starting paths. ESRO

N69-34729# Deutsche Gesellschaft für Luft- und Raumfahrt, Stuttgart (West Germany).
PROCEEDINGS OF THE MEETING OF THE SCIENTIFIC COMMITTEE ON ROTATING WING AIRCRAFT AND PROPELLERS. TILT PROPELLERS AND TILT ROTORS [BERICHT UEBER DIE SITZUNG DES FACHAUSSCHUSSES DREHFLUEGELFLUGZEUGE UND LUFTSCHRAUBEN, KIPPPROPELLER UND KIPPROTOREN]
Apr. 1969 242 p refs In GERMAN; ENGLISH summary Conf. held at Stuttgart, 28 Nov. 1968
(DLR-MITT-69-06) Avail: CFSTI

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6. EXPERIMENTAL INVESTIGATIONS OF FLOW SEPARATION PROBLEMS IN TILT WING AIRCRAFT DURING LANDING TRANSITION H. Loebert (Ver. Flugtechnische Werke G.m.g.H., Munich) p 191–236 refs (See N69-34735 20-02)

7. PROSPECTS IN SPECIAL-PURPOSE PROPELLER DESIGN L. Hoffmann (Propellerwerk Hoffmann, Rosenheim) p 237–245 (See N69-34736 20-02)

N69-34730# Bölkow Entwicklungen K. G., Munich (West Germany).

TILTING ROTOR AIRCRAFT WITH RIGID ROTOR 'SYSTEM BOELKOW' [KIPPROTORFLUGZEUGE MIT GELENKLOSEM ROTOR 'SYSTEM BOELKOW']

P. Bitterle *In* Deut. Ges. für Luft- und Raumfahrt Proc. of the Meeting of the Sci. Comm. on Rotating Wing Aircraft and Propellers. Tilt Propellers and Tilt Rotors Apr. 1969 p 7–45 refs In GERMAN (See N69-34729 20-02)

Avail: CFSTI

The design of a tilt wing aircraft meeting requirements as helicopter flight characteristics in slow speed flight and gliding flight, autorotation landing capability at zero power, and a starting weight of 25 tons is described. The rotor diameter, the wing configuration, the installed power, gliding properties, the rotor geometry and rotor blade design are discussed. ESRO

N69-34731# Bölkow Entwicklungen K. G., Munich (West Germany).

INSTABILITIES OF THE ROTOR-NACELLE-WING CONFIGURATION OF TILT ROTOR AIRCRAFT CAUSED BY AERODYNAMIC FORCES [DURCH LUFTKRAEFTE BEDINGTE INSTABILITAET DES ROTOR-GONDEL-FLUEGEL-SYSTEMS VON KIPPROTORFLUGZEUGEN]

K. Heinig *In* Deut. Ges. für Luft- und Raumfahrt Proc. of the Meeting of the Sci. Comm. on Rotating Wing Aircraft and Propellers. Tilt Propellers and Tilt Rotors Apr. 1969 p 47–69 refs In GERMAN (See N69-34729 20-02)

Avail: CFSTI

By means of linearized differential equations, the influence of several parameters on the rotor whirl flutter is derived and the stability of a rotor-nacelle-wing system is discussed. It appeared that the rotor whirl flutter can be suppressed at characteristic frequencies of the rigid rotor by means of a relatively low wing rigidity. ESRO

N69-34732# Vereinigte Flugtechnische Werke G.m.b.H., Munich (West Germany).

FLIGHT PHYSICS OF THE DEVELOPMENT OF TILT WING TANDEM CONFIGURATIONS [FLUGPHYSIKALISCHE ASPEKTE DER ENTWICKLUNG VON KIPPFLUEGEL-TANDEM-KONFIGURATIONEN]

F. Kowalke *In* Deut. Ges. für Luft- und Raumfahrt Proc. of the Meeting of the Sci. Comm. on Rotating Wing Aircraft and Propellers. Tilt Propellers and Tilt Rotors Apr. 1969 p 70–112 refs In GERMAN (See N69-34729 20-02)

Avail: CFSTI

A survey on the aerodynamic properties of tandem tilt wing aircraft is presented, discussing in particular the deceleration during landing transitions, problems of aerodynamic interference in tandem configurations, and the stability and controllability of such aircraft. Most results were derived from wind tunnel measurements using propelled models. It is concluded that the development of tandem aircraft would be promising. ESRO

N69-34733# Vereinigte Flugtechnische Werke G.m.b.H., Munich (West Germany).

THE PROPELLER PROPULSION AS COMPARED TO OTHER PROPULSION SYSTEMS [DER PROPELLERANTRIEB IM VERGLEICH ZU ANDEREN ANTRIEBEN]

Heinzjochen Höppner *In* Deut. Ges. für Luft- und Raumfahrt Proc. of the Meeting of the Sci. Comm. on Rotating Wing Aircraft and Propellers. Tilt Propellers and Tilt Rotors Apr. 1969 p 113–161 refs In GERMAN (See N69-34729 20-02)

Avail: CFSTI

A comparison is made between propeller and other aircraft propulsion systems, discussing propeller efficiency, static thrust, thrust/weight ratio, flight range and payload, starting power, acceleration and climbing properties, fuel consumption, weight of propulsion system, operational properties, aeroacoustics and noise generation, engine failure, maintenance, development problems and secondary influences, inlet problems in lift fan and bypass lift engines, jet interference, and vibrational problems. It is concluded that propeller drives are particularly suited for VTOL applications, because of good aerodynamic characteristics, low fuel consumption, high acceleration and the avoidance of new designs as in VTOL jet aircraft. ESRO

N69-34734# Vereinigte Flugtechnische Werke G.m.b.H., Munich (West Germany).

DESIGN CONSIDERATIONS FOR TILT WING AIRCRAFT PROPELLERS [ENTWURFSBETRACHTUNGEN ZU LUFTSCHRAUBEN FUER KIPPFLUEGELFLUGZEUGE]

R. Huber *In* Deut. Ges. für Luft- und Raumfahrt Proc. of the Meeting of the Sci. Comm. on Rotating Wing Aircraft and Propellers. Tilt Propellers and Tilt Rotors Apr. 1969 p 163–190 In GERMAN (See N69-34729 20-02)

Avail: CFSTI

From qualitative considerations of VTOL aircraft propellers and of matching them to the propulsion engine, and from a comparison with other competing drives it is concluded, that propellers are suited for high speed flying, that they can provide high static thrust and acceptable efficiencies in forward flying. As compared to other drives a VTOL propeller, which is a compromised design, seems to be favorable, in particular because it is an established design in principle. ESRO

N69-34735# Vereinigte Flugtechnische Werke G.m.b.H., Munich (West Germany).

EXPERIMENTAL INVESTIGATIONS OF FLOW SEPARATION PROBLEMS IN TILT WING AIRCRAFT DURING LANDING TRANSITION [EXPERIMENTELLE UNTERSUCHUNGEN ZUM PROBLEM DER STROEMUNGSABLOESUNG BEI KIPPFLUEGELFLUGZEUGEN IN DER LANDETRANSITION]

H. Löbert *In* Deut. Ges. für Luft- und Raumfahrt Proc. of the Meeting of the Sci. Comm. on Rotating Wing Aircraft and Propellers. Tilt Propellers and Tilt Rotors Apr. 1969 p 191–236 refs In GERMAN (See N69-34729 20-02)

Avail: CFSTI

Flow conditions around wings of tilt wing aircraft during landing transition are studied by means of wind tunnel experiments with driven-engine models. ESRO

N69-34736# Propellerwerk Hoffmann, Rosenheim (West Germany).

PROSPECTS IN SPECIAL-PURPOSE PROPELLER DESIGN [KONSTRUKTIONSMOEGLICHKEITEN DES LUFTSCHRAUBENBAUS FUER BESONDERE AUFGABEN]

Ludwig Hoffmann *In* Deut. Ges. für Luft- und Raumfahrt Proc. of the Meeting of the Sci. Comm. on Rotating Wing Aircraft and Propellers. Tilt Propellers and Tilt Rotors Apr. 1969 p 237-245 In GERMAN (See N69-34729 20-02)
Avail: CFSTI

The design of a plywood propeller set for the Transall aircraft is described and a comparison is made with aluminum propellers as concerns service life and mechanical properties. ESRO

N69-34802# Dornier-Werke G.m.b.H., Munich (West Germany).
DORNIER-POST, No. 4, 1968
Gerhard Patt ed. [1969] 46 p
Avail: CFSTI

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N69-34804# Dornier-Werke G.m.b.H., Munich (West Germany).
BALLOON PROBE
In its Dornier-Post, No. 4, 1968 [1969] p 25 (See N69-34802 20-02)
Avail: CFSTI

The objectives and the design of balloon flight astronomical observations of scintillation, zodiacal light, infrared, visible, ultraviolet, and gamma radiation are described. The experiments are carried out by the Heidelberg-Königstuhl Observatory, Germany. ESRO

N69-34915*# Michigan Univ., Ann Arbor.
LABORATORY EXPERIMENTS ON REVERTED RUBBER FRICTION
G. H. Nybakken, R. J. Staples, and S. K. Clark Washington NASA Aug. 1969 58 p refs
(Grant NGR-23-005-010)
(NASA-CR-1398; TR-7) Avail: CFSTI 01C

Laboratory experiments were carried out to explain the mechanism of reverted rubber skidding as was observed on aircraft tires. It was determined that surface heat generation is the cause of this rubber degradation, and that such reverted rubber exhibits remarkably low friction coefficients on wet surfaces, at all speeds, compared to unreverted rubber on dry surfaces. The process of reverted rubber sliding can take place at ambient temperatures, and is not dependent on the simultaneous presence of heat. It is believed to be caused by a thin water film between the soft reverted rubber and the rigid roadway. Author

N69-34955# National Transportation Safety Board, Washington, D.C.
BRIEFS OF ACCIDENTS, 1967. NO. 11: US CIVIL AVIATION
Feb. 1969 107 p
(PB-183246) Avail: CFSTI CSCL 01B

The publication contains reports of U. S. Civil aircraft accidents, in brief format. It is issued monthly and includes those accidents analyzed and processed during the preceding month. The reports are reproduced directly from the coded record on magnetic tape by electronic data processing equipment. The cause factor, accident types, operational phases, and kinds of flying have been tabulated. Author (USGRDR)

N69-34988*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SPIN-TUNNEL INVESTIGATION OF A 1/20-SCALE MODEL OF A STRAIGHT-WING, TWIN-BOOM, COUNTER-INSURGENCY AIRPLANE
Henry A. Lee Washington Aug. 1969 28 p ref
(NASA-TM-X-1602) Avail: CFSTI CSCL 01C

An investigation has been made to determine the erect and inverted spin and recovery characteristics of a 1/20-scale dynamic model of a straight-wing, twin-boom, counter-insurgency airplane. Tests were made for the normal loading with the center of gravity at 28-percent mean aerodynamic chord and for a forward and rearward position at 17-percent and 30-percent mean aerodynamic chord, respectively. The landing configuration for the normal loading was also investigated. Additional tests were made to determine the effect of the sponsons, the external wing-tip-mounted missiles, external rocket pods, and an external gun pod. The use of rockets as an emergency recovery device was also investigated. The test results indicate that the airplane will spin in the erect attitude for all loading conditions and will spin inverted only for aileron-with control settings. The optimum control technique for recovery from all spins is movement of the rudder to against the spin followed about one-half turn later by neutralization of the longitudinal and lateral controls. Stores mounted on the wings and sponsons will have no appreciable effect on the spin and recovery characteristics. Author

N69-35131*# Massachusetts Inst. of Tech. Cambridge. Electronic Systems Lab.
THE AERODYNAMIC SURFACE LOCATION PROBLEM IN OPTIMAL CONTROL OF FLEXIBLE AIRCRAFT
Timothy Lee Johnson (M.S. Thesis) Jun. 1969 64 p refs
(Grant NGL-22-009-124; MIT DSR Proj. 76265)
(NASA-CR-104089; ESL-R-387) Avail: CFSTI CSCL 01C

The basic physical relationships involved in control of a flexible aircraft disturbed by random wind gusts were used in formulating the surface location problem as one in optimal control of a distributed system, using a limited number of point-force controllers. The three phases of this problem—estimation, control, and surface placement—were then solved by means of the matrix minimum principle and the calculus of variations. The variational equations were greatly simplified and the order of the problem considerably reduced by the use of optimal controllers at each stage in the search for optimal surface locations. These simplifications, plus advanced computational techniques made the general solution of the problem practically feasible. Aircraft physics had to be investigated in great detail in order to feasible. Aircraft expressing the distributed nature of the system exactly. A computer program was written which stored these equations and used them in solving the surface location problem for a general aircraft. Author

N69-35181# Politecnico di Torino (Italy). Instituto di Macchine e Motori per Aeromobili.
CONSIDERATIONS ON THE LIFTING APPARATUS OF AIR CUSHION VEHICLES [CONSIDERAZIONI SULL'APPARATO DI SOSTENTAZIONE DEI VEICOLI A CUSCINO D'ARIA]

G. Bussi Assoc. Tec. Automobile Oct. 1967 30 p refs In ITALIAN *Its* Ric. ATA, Quaderno 35, Suppl. to No. 10 (Publ-86) Avail: CFSTI

A general survey of the lifting theory of ground effect machines is presented. The internal flow is analyzed and the lifting fans are studied in detail. The criteria for selecting either axial or radial fans are examined and coupling engine fans are also discussed. ESRO

N69-35301# Air Force Cambridge Research Labs., Bedford, Mass. Aerospace Instrumentation Lab.
TETHERED BALLOON WORKSHOP Proceedings, Oct. 1967
Thomas W. Kelly, ed. Mar. 1968 193 p refs AFCRL Workshop held in Bedford, Mass., Oct. 1967 *Its* Spec. Rept. No. 72 (AD-676037; AFCRL-68-0097) Avail: CFSTI CSCL 1/3

The subjects discussed include tethered balloon motion, balloon design, Fiberglas tether cables, tethered balloon instrumentation, a tethered balloon winch, and several operational programs that use tethered balloon systems. For individual titles, see N69-35302 through N69-35320.

N69-35302# National Center for Atmospheric Research, Boulder, Colo.
EQUATIONS OF MOTION OF A TETHERED KITE BALLOON
J. H. Smalley *In* AFCRL Tethered Balloon Workshop Mar. 1968 p 1–7 refs (See N69-35301 20-02)
Avail: CFSTI

The classical equations of motion of a tethered balloon are presented without derivation. Comparison is made with the similar equations for an airplane. A very brief discussion is given of how the equations might be utilized and of some possible benefits which might arise. Author

N69-35303# Sea-Space Systems, Inc., Torrance, Calif.
DUAL-DIAGNOSTIC BALLOON ARRAYS FOR THE AJAX EVENT
Dewey Struble *In* AFCRL Tethered Balloon Workshop Mar. 1968 p 9–14 (See N69-35301 20-02)
Avail: CFSTI

Two tethered balloon arrays were provided to support 300-lb instrumentation packages above the surface on the AJAX nuclear event at the Nevada Test Site, Mercury, Nevada. The Sea-Space Systems' superpressure balloons successfully lofted LRL instruments and complied with stringent telemetry positioning and boresighting requirements. Although designed for 26 mph wind speeds, the balloons withstood winds gusting to 32 mph. A positioning accuracy during operational periods of less than 10-ft spherical error was achieved. Operational flexibility was provided by inflating the balloons in the bottom of an old nuclear crater and then moving the inflated balloons to the operational area. A specially equipped launch truck enabled the balloons to be inflated on board with a taut bubble, thereby increasing wind capacity. Positioning accuracy presented a definite technical problem in array rigging since a very "hard" system was required to maintain spherical positioning to 10 ft and yaw to 5° over an extended unattended period. This was achieved by using fiberglas cables with an extensive balloon attachment array. Author

N69-35304# Defense Atomic Support Agency, Washington, D.C.
DASA REQUIREMENTS FOR TETHERED BALLOON SYSTEMS
Jack Kelso *In* AFCRL Tethered Balloon Workshop Mar. 1968 p 15–19 (See N69-35301 20-02)
Avail: CFSTI

In performing its mission of studying the effects of nuclear and high explosive detonations in the atmosphere and near the earth's surface, the Defense Atomic Support Agency has successfully employed steel towers, free balloons, and low altitude tethered balloons to position detonation sources and effects sensing instrumentation at desired altitudes and locations. In the event that nuclear testing in the atmosphere is resumed, high altitude tethered balloons would present a more attractive carrier and positioning vehicle. A high altitude tethered balloon capability would ensure maximum control of a nuclear device at all times and precise positioning of a detonation source for missile interaction experiments would present an almost ideal test environment. Author

N69-35306# General American Transportation Corp., Niles, Ill.
TETHERED BALLOON REQUIREMENTS FOR SLEDGE
M. J. Balcerzak *In* AFCRL Tethered Balloon Workshop Mar. 1968 p 21–29 (See N69-35301 20-02)
(Contract DA-49-146-XZ-573)
Avail: CFSTI

The development of the high altitude SLEDGE (simulating large explosion detonable gas experiments) technique has continued during the past year. The over-all objective is to provide a blast and shock environment that simulates the environment produced by 10 to 20 tons of TNT at altitudes up to 100,000 ft. Although the high altitude SLEDGE tests presently contemplated call for free flight balloons, there is a developing need for a tethered capability. The advantages of a tethered detonable gas balloon system are evident. They are that a tethered detonable gas balloon presents a relatively fixed point in space around which missiles and aircraft may be deployed to determine their blast vulnerability, a tethered detonable gas balloon eliminates the need of a tower and its associated degrading effects when used to support TNT for height of burst explosion experiments, and a tethered detonable-gas-balloon capability can be used to static launch high altitude SLEDGE balloons by facilitating instrumentation and payload train deployment. Author

N69-35307# Goodyear Aerospace Corp., Akron, Ohio.
HIGH-ALTITUDE TETHERED BALLOON DESIGN
William F. Conley *In* AFCRL Tethered Balloon Workshop Mar. 1968 p 43–59 ref (See N69-35301 20-02)
Avail: CFSTI

This paper was prepared for presentation at a meeting on tethered balloons held at AFCRL, Hanscom Field, Bedford, Massachusetts. Included is a brief description of balloon and cable design procedure and a more detailed description of system solutions by the use of graphical superposition. Author

N69-35308# Sandia Corp., Albuquerque, N.Mex.
BALLOON OPERATIONS ON OPERATION ROLLER COASTER
H. G. Laursen *In* AFCRL Tethered Balloon Workshop Mar. 1968 p 61–70 (See N69-35301 20-02)
Avail: CFSTI

Balloons having 7,000 lb of net lift were used to support a mobile array of ninety motor-driven samplers and 720 sticky cylinders and plates. The array covered an area of 1,800 ft wide by 1,500 ft high. A detailed discussion of the difficulties encountered is given. Six out of eight attempts to fly the complex instrument arrays were successful. Author

N69-35309# Raven Industries, Inc., Sioux Falls, S.Dak.
THE USE OF A TETHERED 15000 POUND GROSS LIFT NATURAL SHAPED BALLOON FOR REMOTE LOGGING OPERATIONS

Russell A. Pohl *In* AFCRL Tethered Balloon Workshop Mar. 1968 p 71–81 (See N69-35301 20-02)
Avail: CFSTI

Numerous studies resulted in the technical and economic feasibility of the use of a tethered balloon to transport logs in low or loss economic sites. Based on these studies and other engineering evaluations, a natural shaped balloon was designed, fabricated, and tested. A full scale field test, using a tethered balloon with a payload capacity of 12,000 lb, is presently in operation at a logging site in Oregon. The basic technique involves the use of a tethered balloon as an above terrain technique for cut-to-landing site log transport. The balloon is tethered on a cabling arrangement which provides a track and power for transportation of logs from the cutting site to a landing site. The cable is a continuous loop design with a dual tree-stump anchor point usually located near the top of the hill and the power source at the landing site. Since the cable is continuous, and the balloon is coupled to the cable at a fixed point, the balloon can be shuttled back and forth between the cut and landing site where the yarder is located. A vertical cable attached to the balloon bottom end-fitting is used as the load train for the logs. Author

N69-35310# Raven Industries, Inc., Sioux Falls, S.Dak.
TETHERED HOT AIR BALLOONS
James Winker *In* AFCRL Tethered Balloon Workshop Mar. 1968 p 83–93 (See N69-35301 20-02)
Avail: CFSTI

In spite of the many advantages of conventional captive balloons which make them useful vehicles, there are a few drawbacks which do limit their application, particularly in short term operations. These include cost of the lifting gas, time and care required for inflation and the problem of protecting the inflated balloon between uses. The hot air tethered balloon goes far toward solving these problems and it makes practical some applications for which tethered balloons might not otherwise be considered. Presented here are some of the factors which should be considered in a hot air tethered operation and some of the programs which have utilized hot air balloons. Author

N69-35311# Ministry of Technology, Cardington (England).
SOME ASPECTS OF HIGH-ALTITUDE TETHERED BALLOON FLIGHT
L. A. Speed *In* AFCRL Tethered Balloon Workshop Mar. 1968 p 95–104 (see N69-35301 20-02)
Avail: CFSTI

A review of tethered balloons intended for use at altitudes above 15,000 ft is made. The efforts to achieve this altitude goal since 1917 are presented along with the significant data pertinent to each balloon. The design process is analyzed to provide information concerning the effects of weight and volume on high-altitude tethered balloons. Several schemes of flying balloons in tandem are presented and discussed. The flying of tethered balloons in high winds at altitude can cause many difficulties and may render it impractical to consider. Finally, the problems of ground handling in various wind situations are addressed. Author

N69-35312# Naval Ordnance Lab., White Oak, Md.
BARRAGE BALLOON SKYHOOK
Gruver H. Martin *In* AFCRL Tethered Balloon Workshop Mar. 1968 p 105–114 (See N69-35301 20-02)
Avail: CFSTI

An experiment was conducted to determine the feasibility of using a large captive balloon to deploy an array of pressure sensors vertically above a large explosion. A British World War-II type barrage balloon was used up to an altitude of 8,600 ft. above mean sea level. The payload consisted of a 5-station gage array distributed along the tether. A 5/16-in. diameter stranded fiberglas cable was used for the single tethering line. As a result of the tests, it is concluded that a distributed payload of up to 750 lb can be deployed in a near vertical and very stable array with a barrage-type balloon up to 10,000 ft mean sea level. The system can be launched and maintained aloft under fairly adverse weather conditions and has significant advantages over other methods of gage positioning, for example, rocket emplacement, in terms of simplicity, reliability, and economy. Author

N69-35317# National Aeronautics and Space Administration, Wallops Station, Wallops Island, Va.
DESCRIPTION AND PERFORMANCE CHARACTERISTICS OF A CAPTIVE AIRFOIL BALLOON SYSTEM USED IN THE INITIAL PHASE OF THE AEROPALYNOLOGIC SURVEY PROJECT
Mendel N. Silbert *In* AFCRL Tethered Balloon Workshop Mar. 1968 p 145–162 refs (See N69-35301 20-02)
Avail: CFSTI CSCL 01C

The project requirements included the need for a system capable of lifting itself and a payload up to and including an altitude of 1,000 ft, remaining aloft for a one-week period, and capable of returning usable data to the ground. The short time increment between request and need for a lifting system did not permit specification, procurement, and evaluation of a new system. However, an available balloon system was used. Author

N69-35318# Nevada Univ.
REINFORCED FIBERGLAS AS A BALLOON TETHER
Robert B. Mc Kee *In* AFCRL Tethered Balloon Workshop Mar. 1968 p 163–176 (See N69-35301 20-02)
Avail: CFSTI

A brief summary of and the design philosophy leading to reinforced fiberglas as the selected tether is discussed. Several problems that were encountered in production of the tether are discussed, as well as the problems associated with splicings and end fittings. The effect of tether length on strength is demonstrated and the difficulties of manufacturing glass tethers with greater strength are presented. It is concluded that reinforced glass tethers are feasible in long lengths and do possess the required tensile strength, flexibility, and resistance to environment and that larger size tethers can be made by combining smaller tethers into a flexible matrix. Author

N69-35319# Robert E. Fulton Co., Danbury, Conn.
SKYHOOK AERIAL RESCUE SYSTEM
John H. Gilchrist *In* AFCRL Tethered Balloon Workshop Mar. 1968 p 177–195 refs (See N69-35301 20-02)
Avail: CFSTI

Because the tethered ballon is small and flies at a low altitude, its use as a rescue vehicle is discussed. This balloon was developed as a land-to-air and sea-to-air system for inflight recovery of men and equipment in remote regions not accessible to conventional methods of recovery. The balloon system and design parameters generated by operational requirements are included. E.H.W.

N69-35320# Ohio State Univ., Columbus.
A TETHERED HEAVIER-THAN-AIR VEHICLE FOR ATMOSPHERIC SOUNDING
Robert D. La Rue *In* AFCRL Tethered Balloon Workshop Mar. 1968 p 197–205 (See N69-35301 20-02)
Avail: CFSTI

The main objectives of these studies are to explore and define the physical properties of the cloud systems and to develop means by which they may be modified to produce additional water

supplies for the region. Various ground stations, including radar, in and near the field study area were the major data acquisition sources for the project. While the information obtained from these sources proved to be valuable contribution to the knowledge of the cloud processes and their modifications, it was indirect information. It is felt that observations taken directly within the cloud system should be made. Author

N69-35762*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
FIXED-BASE SIMULATOR PILOT RATING SURVEYS FOR PREDICTING LATERAL-DIRECTIONAL HANDLING QUALITIES AND PILOT RATING VARIABILITY
Lawrence W. Taylor, Jr., and Kenneth W. Iliff Washington Aug. 1969 115 p refs
(NASA-TN-D-5358) Avail: CFSTI CSCL 01C

Pilot ratings of lateral-directional handling qualities were collected for a wide range of simplified aircraft characteristics through the use of a simple fixed-base simulator with a color contact analog display. The results of the general survey were obtained with an engineer as the subject and are contained in 45 plots involving five parameters. In another survey, utilizing the same simulation, ratings were obtained from many pilots in order to study the variability in pilot ratings among pilots and the differences in pilot rating that result from changes in mission. The standard deviation of individual pilot ratings ranged from 1.0 at the "good" end of the scale to 2.0 in the middle of the scale. Ratings for specific missions were generally numerically higher (more adverse) than those for the general mission for the same vehicle characteristics. Author

N69-35783*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
INFORMATIVE INTERPRETATION OF SUBJECTIVE PILOT RATINGS CONCERNING THE MANEUVERABILITY OF FLIGHT VEHICLES [INFORMACYJNA INTERPRETACJA SUBIEKTYWNYCH OPINII PILOTOW O STEROWNOSCI APARATOW LATAJACYCH]
Mieczyslaw Rybak Washington NASA Aug. 1969 32 p refs Transl. into ENGLISH from Prace Inst. Lotnictwa (Poland), no. 36, 1968 p 17–28
(Contract NASw-1692)
(NASA-TT-F-12427) Avail: CFSTI CSCL 01C

This study is an attempt at an analytical comparison of subjective pilot ratings based on the Cooper scale with an objective criterion of the aircraft handling qualities based upon Shannon's information theory. Relationships were established for (1) the subjective pilot rating as a function of his information load criterion, and (2) accident probability due to an involuntary pilot's error as a function of his opinion. On the basis of some experimental results, a partial verification of these relationships is presented. The mean error of analytical estimation does not exceed 0.5 on the Cooper scale. Author

N69-35861*# Flight Safety Foundation, Inc., Arlington, Va.
GENERAL-AVIATION PILOT REACTIONS TO AND OPINIONS ON GROOVED RUNWAYS
George E. Cranston Washington NASA Aug. 1969 27 p
(Contract NAS1-8668)
(NASA-CR-1428) Avail: CFSTI CSCL 01C

At the time the survey was performed, there were four commercial airports in the continental United States that had at least one grooved runway. Personal interviews were conducted between general-aviation pilots and aviation safety specialists at these sites by using a prepared questionnaire to obtain the data discussed in this paper. The results of the survey and study show that the grooving of runways has a pronounced beneficial effect and provides increased safety for high-speed general-aviation aircraft operations by the reduction of hydroplaning and increasing braking action during wet runway conditions. Pilots operating light, low-speed aircraft did not generally realize these benefits as the runway lengths and widths at these airports far exceeded their operational requirements under all anticipated circumstances involved with this problem. Author

N69-35978# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Institut für Dynamik der Flugsysteme.
SAILPLANE RESEARCH AND DESIGN IN GERMANY [SEGELFLUGZEUG UND -FORSCHUNG IN DEUTSCHLAND]
Hans Zacher *In its* DVL News, No. 39 Mar. 1969 p 443–445 In GERMAN (See N69-35976 20-34)
Avail: CFSTI

After a short historical survey on the development of sailplanes some aerodynamic data of existing planes are given and wing profiles are compared. ESRO

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N69-34652*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF DYNAMIC PERFORMANCE LIMITATIONS OF FAST RESPONSE (150 to 200 Hz) ELECTROHYDRAULIC SERVOS
John R. Zeller Washington Aug. 1969 25 p refs
(NASA-TN-D-5388) Avail: CFSTI CSCL 13L

Fast response (150 to 200 Hz) electrohydraulic valve-controlled piston servo systems are used as research tools in experimental dynamics and controls studies. The components within these systems must operate at their limits of capability to achieve these high rates of response. A detailed nonlinear analytical model of these systems was formulated. The accuracy of this model was verified by comparing model dynamic performance against actual experimental data for a specific application. The analysis has led to a new generalized design criterion which in specific applications assists in determining a maximum region of dynamic performance capability. Author

N69-34689# Bosch (Robert) G.m.b.H., Stuttgart (West Germany). Laboratorium für Elektrochemie.
DEVELOPMENT OF BATTERIES FOR AUTOMOBILES WITH ELECTRIC PROPULSION [ENTWICKLUNG VON BATTERIEN FUER ELEKTRISCH ANGETRIEBENE KRAFTFAHRZEUGE]
Hermann Dietz *In its* Tech. Rept., Vol. 2, No. 5 Nov. 1968 p 211–219 refs In GERMAN; ENGLISH summary (See N69-34688 20-34)
Avail: CFSTI

Power sources for electric automobiles require a high energy/weight ratio and favorable service and maintenance at low initial and operating costs. This is a survey on existing batteries

and systems under development. Fuel cells, metal-air, non-aqueous, high temperature, and organic electrolyte batteries are discussed. ESRO

N69-34910*# Tracerlab, Inc., Richmond, Calif. Lab. for Electronics, Inc.
KSC SNAP-27 RADIOLOGICAL CONTROL PLAN
Sep. 1968 138 p refs
(Contract NAS10-5320)
(NASA-CR-104121; TLW-6023) Avail: CFSTI CSCL 10B

The SNAP-27 radioisotope-fueled thermoelectric power system will provide the electrical power for the Apollo Lunar Surface Experimental Packages that are to be placed on the moon by the astronauts. The ^{238}Pu fuel for the SNAP-27 will be transported in a separate cask mounted on the Lunar Module. This radiological control plan is intended to: (1) provide detailed procedures to ensure that there is no unnecessary exposure or contamination of workers, the general public, or the biosphere during a nominal mission; (2) provide detailed procedures to cope with all conceivable accidents or incidents quickly and with minimal hazard to operating personnel; and (3) fulfill and exceed the minimum radiological safety criterial specified for the SNAP program. The period of concern is from the receipt of the fuel at KSC to orbital insertion. Environmental data from the period before the actual receipt of the fuel is also necessary to make sound operational decisions based on data comparison. Author

N69-34962*# Aerojet-General Corp., Sacramento, Calif. Liquid Rocket Operations.
INDUCER DYNAMICS FULL-FLOW, FULL-ADMISSION HYDRAULIC TURBINE DRIVE Final Report
J. Farquhar, B. K. Lindley, E. B. McKinney, G. K. Olson, and P. S. Buckmann 24 Aug. 1969 237 p refs
(Contract NAS3-7977)
(NASA-CR-72568; AGC-9400-18) Avail: CFSTI CSCL 10B

An analytical computer model for the transient performance of a two-speed inducer system, hydraulically-designed for operation in liquid hydrogen was formulated. A two-speed inducer system was designed, fabricated, assembled, and tested. A hydraulic turbine, powered by the flow from a rotor connected to a high-speed drive, drives the low-speed inducer. The high-speed rotor blading is mounted between the low-speed inducer and the hydraulic turbine blading with essentially all of the delivered flow passing through each row of blades. The system was designed to operate at a flow rate of 4900 gpm with a 25 ft NPSH and an over-all cavitating head rise of 5453 ft; the high-speed rotor to operate at 44,500 rpm and the low-speed inducer at 18,800 rpm. This system could potentially reduce the required NPSH of a liquid hydrogen engine. The test results indicate that the system is dynamically stable, but additional research is needed to improve the cavitation performance of the high-speed rotor. The computer model was successfully developed. Author

N69-34971*# Ion Physics Corp., Burlington, Mass.
IMPROVED SOLAR CELL CONTACTING TECHNIQUES Final Report
R. W. Sudbury and K. A. Stirrup Feb. 1969 48 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952144)
(NASA-CR-104136) Avail: CFSTI CSCL 10B

Work on aluminum, nickel and copper contacted solar cells using ion beam sputtering technology is reported. Apparent damage to the cells during contacting and the effect of annealing is reported. Environmental tests were made at high temperature and humidity. Aluminum contacted solar cells were fabricated for an uncoverslipped CeO_2 antireflection coated cell. Solderless interconnection of aluminum contacted cells was made by ultrasonic bonding of ribbons that could withstand a 1750 gram pull perpendicular to the solar cell. Author

N69-34973*# Gulf General Atomic, San Diego, Calif.
RADIATION EFFECTS IN SILICON SOLAR CELLS Quarterly Report
J. A. Naber and B. C. Passenheim 10 Apr. 1969 14 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952387)
(NASA-CR-104137; GA-9312) Avail: CFSTI CSCL 10B

The nature of the defects responsible for the output degradation of silicon solar cells irradiated by space radiation, particularly the effects of lithium on the production and annealing of damage in silicon are reported. Samples of high purity silicon have been lithium diffused by the paint on and lithium tin bath techniques. Samples of various lithium content have been prepared, and the lithium content is being measured by room temperature resistivity and neutron activation analysis techniques. The first of a series of samples has been investigated. Resistivity and minority carrier lifetime were measured as a function of temperature before and after irradiating the sample with 30 MeV electrons. During irradiation, the lifetime degradation and annealing rates were measured, at room temperature and above, as a function of fluence. Isothermal anneals were performed in an effort to determine the temperature dependence of the annealing rate. Author

N69-34990*# Solar, San Diego, Calif.
BRAYTON CYCLE RADIANT GAS HEATING SYSTEM Final Report
L. G. Desmon Apr. 1969 142 p refs
(Contract NAS3-10945)
(NASA-CR-72575; ER2062) Avail: CFSTI CSCL 10A

A radiant gas heating system for use in ground testing a Brayton cycle space power system has been designed and fabricated. It is believed that this is one of the few, if not the only quartz tube lamp heater—heat exchanger system built to operate in vacuum at 1×10^{-5} Torr, in air at one atmosphere, and at any pressure in between. Heat transfer and stress analyses are presented in brief, as are the activities in the fields of controls system design, quartz tube lamp development, and surface coating tests. Author

N69-36006# Sonotone Corp., Elmsford, N.Y.
OPTIMUM STRUCTURES FOR MINIATURE Ni-Cd SEALED CELLS AND BATTERIES
L. Belove, S. Thornell, and J. Pivarnik Mar. 1969 212 p refs
(Contract DA 28-043-AMC-02361(E))
(AD-688520; ECOM-02361-F) Avail: CFSTI CSCL 10/3

The tasks relating to the optimization of the electro-chemical aspects of cell design were primarily divided into three major categories as follows: The effects of various electrochemical treatments on the energy density of the nickel oxide positive electrode were evaluated; In order to maximize the ratio of negative electrode capacity to electrode weight, the performance levels of pasted cadmium (CdO) electrodes were studied; The effects of electrolyte quantity and concentration on cell performance were studied; Furthermore, the ratio of negative to positive plate ampere-hour capacities was found to have a marked effect on overall cell performance. The desired optimum ratio was ultimately accomplished by increasing both the porosity and volume of the negative electrode. Author (TAB)

N69-35095# Forsvarets Forskningsanstalt, Stockholm (Sweden).
DEVELOPMENT OF SLOTTED CHARGE FOR GAS GENERATOR TYPE RB 05 [UTVECKLING AV SLITSLADDNING FOER GASGENERATOR TILL RB 05]
A. Magnusson Nov. 1967 36 p refs In SWEDISH
(FOA-2-A-2510-46) Avail: CFSTI

Development and testing of a Thiokol-ammonium nitrate-base powder charge, TN 70-L07, is described. The gas generated by this charge is used to drive the servo for the control mechanism of Sidewinder-type missiles. According to specifications, two of the charges were to provide a pressure of 70 to 110 kp/cm^2 starting $\leq$0.2 sec after ignition and for a minimum burning time of 24 sec within a temperature range from -45° to $+60^\circ$ C. Tests were conducted with the charges installed in the servo loop. Thermal cycling and vibration tests were also conducted. The charges were found to meet all specifications. Transl. by K.W.

N69-35431*# Electro-Optical Systems, Inc., Pasadena, Calif.
DEVELOPMENT OF THERMIONIC CONVERTERS Quarterly Progress Report.
Dean Jacobson 21 Apr. 1969 25 p Prepared for JPL
(Contracts NAS7-100; JPL-952255)
(NASA-CR-104102; EOS-4018-Q-1; QPR-1) Avail: CFSTI CSCL 10A

Initial progress is reported in a program to design and develop low-power, high-efficiency thermionic converters of cylindrical geometry. The converters will be capable of being integrated to form a modular power supply. The central philosophy of this approach is to increase the reliability of thermionic space power supplies by redundancy of the basic component. Author

N69-35432*# Electric Storage Battery Co., Yardley, Pa. Carl F. Norberg Research Center.
HEAT STERILIZABLE IMPACT RESISTANT CELL DEVELOPMENT Quarterly Report, 1 Oct. – 31 Dec. 1968
G. W. Bodamer and A. M. Chreitzberg 9 May 1969 42 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951296)
(NASA-CR-105272) Avail: CFSTI CSCL 10C

Data accumulated during this quarter show that the presence of excessive vapors of catalyst 11 reduced the amount of current which could be withdrawn at higher rates of discharge. In the case of cells sealed with hardener 927, some sensitivity to resin/catalyst ratio seemed to appear. The most severe effects were caused by the presence of a heat shrinkable polyolefin tubing used as insulation on plate leads. Work has continued on cycling prior to heat sterilization but no specific recommendations are made at this time. Cell performance after 72 or 100 hours of sterilization in the wet and sealed condition has improved. Wet life as a function of separator wet thickness has been estimated. The cycle life of 24 amp-hr cells after heat sterilization is now limited by AgO penetration. An increase in the number of layers of SWRI-GX separator from 6 to 9, an increase in ZnO/Ag ratio, and the use of sintered Teflonated negatives in more recently constructed cells are changes directed toward attaining ninety 50% DOD cycles in 18 months of wet charged life with or without 4000 g shock resistance. Author

N69-35502# Politecnico di Torino (Italy). Istituto di Macchine e Motori per Aeromobili.
A METHOD FOR EVALUATING THE OFF-DESIGN PERFORMANCE OF A RADIAL INFLOW TURBINE AND COMPARISON WITH EXPERIMENTS [PREVISIONE TEORICA DELLE PRESTAZIONI DI TURBINE RADIALI E VERIFICA SPERIMENTALE]
Andrea Dadone and Maurizio Pandolfi 1968 25 p refs In ITALIAN; ENGLISH summary
(Contract CNR-115-0376-0-0862)
(Publ-100) Avail: CFSTI

A method is outlined for predicting the off-design performance of radial inflow turbines. A comparison is made with experimental data obtained from a small radial turbine and the published data for larger ones. A good agreement is found between theoretical predictions and experimental results. Author (ESRO)

N69-35512*# Thermo Electron Engineering Corp., Waltham, Mass.
DESIGN AND FABRICATION OF ADVANCED THERMIONIC CONVERTERS Final Report
Nov. 1968 408 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951263)
(NASA-CR-105322; TE4055-65-69) Avail: CFSTI CSCL 10A

Task I centered on the iterative construction of 10 engineering models of a solar energy thermionic converter, and Table I describes their main features. In the last three models, the collector-radiator structure of the previous models was replaced by a heat pipe. At the culmination of the effort, the converter with a heat pipe structure had achieved close to a 70% reduction in weight; however, its performance was the same as that of typical converters with rhenium electrodes, and it did not reach the goal of 20 watts/cm^2 at 0.8 volt, 1700°C. Task II involved a generator flux analysis to determine the best number of converters to match the converter heat requirements to the available solar energy, the optimum cavity aperture size, the required adjustments of surface emissivity and absorptivity values to insure even flux distribution, and the effects of changes in emitter temperature and heat input on flux distribution within the generator. Based on this analysis a 16-converter generator, using converters with heat pipe collector-radiators, was designed in detail. Author

N69-35537*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE CHARACTERISTICS OF A 14.3-KILOVOLT-AMPERE MODIFIED LUNDELL ALTERNATOR FOR 1200 HERTZ BRAYTON-CYCLE SPACE-POWER SYSTEM
David S. Repas and Richard A. Edkin Washington Sept. 1969 28 p refs
(NASA-TN-D-5405) Avail: CFSTI CSCL 10A

The measured performance of the alternator is presented. Test results include alternator saturation curves, losses and efficiency, voltage unbalance, harmonic analysis, machine reactances, and time constants. The peak electromagnetic efficiency of the alternator was 93.6 percent for a unity power factor load of 9.5 kW. For an output of 14.3 kVA at 0.75 power factor lagging, the alternator electromagnetic efficiency was 90.3 percent. Author

N69-35558*# Rensselaer Polytechnic Inst., Troy, N.Y. Nuclear Engineering and Science Div.
INVESTIGATION OF THE STRUCTURE OF RADIATION DAMAGE IN LITHIUM DIFFUSED SOLAR CELLS Progress Report, 3 Feb. – 30 Jun. 1969
John C. Corelli 30 Jun. 1969 11 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952456)
(NASA-CR-105289; PR-1) Avail: CFSTI CSCL 10B

The effects of irradiation by 1 to 5 MeV electrons on the optical properties of silicon doped with lithium concentrations in the range from 10^{15} to 10^{17} Li/cm^3 were studied. Damage was determined primarily by infrared spectroscopy in the range from 1 to 50 microns and through photoconductivity in the range from 0.5 to 10 microns. The electron irradiations were performed at $\approx$ 300° K. In the experiments, a paste composed of dispersed

lithium metal (particle size <15 micron) and alumina (15 micron) mixed in mineral oil was applied to the surface of a silicon sample which was then heated at 450° C in an argon or helium gas environment. The diffusion times were varied from 10 min up to several hours, depending on the thickness of the sample and the desired lithium concentration. Preliminary findings on photoconductivity and infrared spectroscopy are discussed. K.W.

N69-35567# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
IMPROVEMENT OF CAVITATION QUALITIES OF LOW PRESSURE VARIABLE-PITCH AXIAL TURBINE WHEELS FOR CAPSULE HORIZONTAL TURBINES
G. A. Svinarev et al Feb. 1969 15 p refs Transl. into ENGLISH from Issled. Prikl. Gidrodinamike (Kharkov), 1965 p 131–138
(AD-687640; FTD-MT-24-06-69) Avail: CFSTI CSCL 10/1

For low pressure heads, horizontal capsule turbines have been found to have better overload capacities than normal, vertical units. In this work, a further investigation is reported which developed a new type of variable pitch turbine blade wheel, the PLG-16, for horizontal capsule turbines, which is better in its power and cavitation properties than earlier models. Author (TAB)

N69-35592 Centre National d'Etudes Spatiales, Paris (France).
SPACE SOLAR GENERATOR DEGRADATION AND INFLUENCE ON THEIR DESIGN [DEGRADATION DES GENERATEURS SOLAIRES SPATIAUX ET INFLUENCE SUR LEUR CONCEPTION]
M. H. Daspet CERTS Determination of Radiation Doses in Space 1969 p 369–382 refs In FRENCH; ENGLISH summary (See N69-35576 20-29)
Copyright Avail: Issuing Activity

For space applications a solar generator was made for converting radiation energy into electrical energy. Several systems have been studied, but two principal versions are used. The first one is the miniaturization of a solar oven, such as those used on the ground, but the realization and utilization of a large focussing mirror in space causes difficulties. The second uses semi-conductor devices to convert the incident electromagnetic radiation into electrical energy without any focussing or concentration subsystem. This system, currently called solar generator, is utilized universally since it has been set up on more than 500 satellites. The major weakness of space solar generators lies in the vulnerability of solar cells to charged particles in space. Present operational solar cells are made of silicon, and from the basic operating principles of a p-n or n-p junction, specially designed for energetic conversion, it appears that the degradation takes place in the bulk of the silicon, the electrical properties of which are modified by collisions with the protons and the electrons. Consequently, researches have been carried out in order to find a solution to this problem. The first solution consists in protecting the cell with a filter, the function of which is to stop charged particles without interfering with the useful solar radiation. It is universally used, but it lowers the power/weight ratio of solar cells. The second solution consists in improving the electronic properties of silicon and in doing it in such a way that they are preserved during the photocell manufacture. A third solution, the most complex and onerous one, consists in elaborating a new type of solar cell, less sensitive to charged particle radiation with a better power/weight ratio, a greater strength and a lower cost price. Cadmium telluride and cadmium sulphide cells are about to offer such advantages. Author (ESRO)

N69-35593 Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
AL ZF H SUB 2 SOLAR CELL BEHAVIOR UNDER IRRADIATION [COMPORTEMENT SOUS IRRADIATION DE LA CELLULE SOLAIRE AL ZF H SUB 2]
M. D. Lasbre *In* CERTS Determination of Radiation Doses in Space 1968 p 287–300 refs In FRENCH; ENGLISH summary (See N69-35576 20-29)
Copyright Avail: Issuing Activity

A systematic survey of silicon n-p solar cells was carried out to find the one most resistant to radiation. Six different types of cells were subjected to irradiation by 4 MeV electrons. Two types obtained by the 'floating zone method' were much less degraded than standard cells. The synthesis of these two types has led to the Al.ZF.H_2 cell, doped with aluminum and made from monocrystals grown under a floating zone with a hydrogen atmosphere. Their behavior under 1 MeV electron irradiation shows that they are approximately six times more resistant than standard cells. Author (ESRO)

N69-35594 Radiotechnique S. A., Suresnes (France).
RADIATION EFFECTS ON THIN FILM SOLAR CELLS [EFFETS DES RAYONNEMENTS SUR LES CELLULES SOLAIRES EN COUCHES MINCES]
J. Lebrun *In* CERTS Determination of Radiation Doses in Space 1968 p 301–306 refs In FRENCH; ENGLISH summary (See N69-35576 20-29)
Copyright Avail: Issuing Activity

After a brief survey of all structures using CdS, AsGa and CdTe thin films, some results are given concerning the radiation effects of 425 KeV to 1.5 MeV electrons, 100 KeV to 2.4 MeV protons and γ rays on them. Doses vary depending on the cases, from 10^{10} to 10^{18}/cm2. Author (ESRO)

N69-35628*# Eagle-Picher Co., Joplin, Mo. Electronics Div.
HEAT-STERILIZABLE, REMOTELY ACTIVATED BATTERY DEVELOPMENT PROGRAM, PHASE 1 Quarterly Report, 1 Jan.–31 Mar. 1969
25 Apr. 1969 30 p Prepared for JPL
(Contracts NAS7-100; JPL-952214)
(NASA-CR-105317; QR-3) Avail: CFSTI CSCL 10C

This report delineates the progress of the development of a heat sterilizable, sealed, remotely activated battery in an investigation of basic cell and battery components. Studies pertaining to the silver oxide plate showed that a single 120 hour sterilization cycle at 135°C will result in a 30%–40% reduction in capacity. Two cycles extend the reduction in capacity by approximately 4%. The plates tend to become stable with respect to weight loss and physical growth after the first 60 hours of 135°C storage. When subjected to the combination of vacuum and temperature necessary to eliminate any residual solvent in the polysulfone seals, the silver oxide plate lost an average of 2.5% in weight and increased in size similar to plates which were sterilized. Plates which were stored at least 60 hours at 135°C were not affected by the vacuum-temperature combination. An effective method of eliminating solvent (methylene chloride) from the polysulfone joints has been developed. This involves a 72-hour storage in an atmosphere of 300 microns or less with a chamber temperature of 85°C. Author

N69-35632*# Textron Electronics, Inc., Sylmar, Calif. Heliotek Div.
DEVELOPMENT OF LITHIUM DIFFUSED RADIATION RESISTANT SOLAR CELLS Final Report
P. Payne 20 Mar. 1969 68 p Prepared for JPL
(Contracts NAS7-100; JPL-952247)
(NASA-CR-105318; Rept-11) Avail: CFSTI CSCL 10B

Lithium doped p-n solar cells were fabricated and delivered for radiation testing and analysis. Statistical analysis of the cell outputs was performed for each lot of cells. Significant improvements in cell efficiencies were made and particularly high efficiencies were obtained with crucible grown lithium cells. The average output ranged from 26.0 mW to 29.0 mW. Lithium evaporations and

various lithium diffusion parameters were investigated. Boron diffusions were also studied and the uniformity of lithium cell output was improved. Investigation of sintering lithium cells showed that in some cases sintering can cause significant improvements in cell output. Measurements over a 2-1/2 year storage period show that in most cases the losses were less than 2% in lithium cells. In general the crucible grown lithium cells showed improvements after storage. The float zone cells diffused at 425°C varied. The float zone cells diffused at 350°C had slightly lower characteristics after one year of storage and after two years showed slight improvement. Author

N69-35689*# General Electric Co., Schenectady, N.Y.
CHARACTERISTICS OF A THERMIONIC CONVERTER WITH A FLUORIDE VAPOR DEPOSITED TUNGSTEN EMITTER ETCHED TO PREFERENTIALLY EXPOSE THE 110 CRYSTAL PLANES
V. C. Wilson and J. Lawrence Washington NASA Aug. 1969 117 p refs
(Contract NAS3-8511)
(NASA-CR-1381; GEST-2107) Avail: CFSTI CSCL 10A

A variable spaced planar thermionic converter was built with a tungsten emitter, a niobium collector and a niobium guard ring. The tungsten emitting surface was a 0.020-inch-thick layer of fluoride vapor deposited tungsten. X-ray analysis and etch pit studies showed this surface was oriented with a (100) plane parallel to the bulk surface. The surface was etched to expose the (110) planes which are inclined 45 degrees to the (100) planes. The surface was then a mass of peaks, ridges and valleys several microns in depth, and had an exposed area about 40 percent greater than the plane surface. The initial output performance of this surface at low cesium pressures and also at large spacings was better than unetched (100) tungsten. The most output was obtained at 10 mils spacing or more for emitter temperatures from 1700°K to 2000°K. Operation for 21.6 hours at 2155°K reduced the sharpness of the points and ridges and the output performance decreased, particularly at larger spacings. Author

N69-35719*# Texas Instruments, Inc., Dallas. Components Group.
SOLAR CELL CONTACT DEPOSITION PARAMETER STUDY. Final Report, 30 Aug. 1968 - 28 Feb. 1969
28 Feb. 1969 23 p
(Contract NAS5-11612)
(NASA-CR-105401; Rept-03-69-28) Avail: CFSTI CSCL 10B

Progress during the second phase of a study to improve the vacuum deposition parameters for titanium-silver contacts deposited on silicon solar cells is reported. Results include identification of the relationship between various contact evaporation parameters and the humidity resistance of the cell contact. Five groups of contacts were evaporated on silicon cells at different substrate temperatures, from which improvement in the contact temperature-humidity resistance was seen when this temperature is lowered to 0°C. A silver thickness range of 5 microns was found to be the most reliable in high humidity, high temperature environments. Also, a silver evaporation rate of 0.29 μ/min produced the most stable contact following accelerated temperature and humidity storage. Fabrication of cells using a turbo-molecular pumped vacuum system showed no improvement over those fabricated using standard production processes. Finally, the contributing factor of Ti-Ag contacts on the cells appeared negative when compared with data obtained on cells processed using standard techniques. A.C.R.

N69-35763*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE IMPROVEMENT OF AN ELECTRONIC POWER SUPPLY FOR GREATER RELIABILITY IN AEROSPACE USE
John P. Quitter and J. W. Schaelchlin (Gen. Dyn./Convair, San Diego, Calif.) Washington Sep. 1969 47 p refs
(NASA-TM-X-1875) Avail: CFSTI CSCL 10A

This report is a brief account of an upgrading program for electronic equipment. Serious design obstacles were overcome that led to the successful development of a highly reliable electronic component for space use. The component discussed is an inverter that provides three-phase 400-Hz power to the Centaur space vehicle. Because of early ground failure and design deficiencies, the inverter has received much engineering attention. This report is concerned with general upgrading of all piece parts used in the inverter, as well as improved mechanical and thermal design. Weaknesses of original piece parts are described, and rationale presented for the choice of better parts. Author

N69-35793*# Eagle-Picher Co., Joplin, Mo. Couples Dept.
HEAT-STERILIZABLE, REMOTELY ACTIVATED BATTERY DEVELOPMENT PROGRAM, PHASE 2. Quarterly Report, 1 Apr. - 30 Jun. 1969
25 Jul. 1969 65 p Prepared for JPL
(Contracts NAS7-100; JPL-952214)
(NASA-CR-105279; QR-4) Avail: CFSTI CSCL 10C

Studies pertaining to the silver oxide electrode show that prior to sterilization the crystalline structure is irregular and has no similarity between plates. After sterilization the plates become more uniform on a plate-to-plate comparison but are less uniform across the surface of an individual plate. An X-ray analysis revealed that prior to sterilization the only phase present was AgO. The predominant phases found after sterilization were Ag and Ag_2O with a small amount of $AgCO_3$. The zinc electrode was found to be physically stable through heat sterilization. This was verified through microscope scanning shots, X-ray measurements and B.E.T. surface area measurements. Due to heat sterilization the resistivity of the separator is reduced to a level slightly above that which would be expected after 24 hours immersion in 1.30 specific gravity potassium hydroxide. Mechanical tests conducted with molded polysulfone cell cases indicate a 40% loss in strength due to 135°C heat sterilization. Author

N69-35992# European Space Research and Technology Center, Noordwijk (Netherlands).
INCREASED SOLAR CELL OUTPUT BY IMPROVED OPTICAL MATCHING. PART 1: THEORETICAL CONSIDERATIONS
G. Seibert Mar. 1969 46 p refs
(ESRO-TN-90-ESTEC)) Avail: CFSTI

The paper presents the theoretical part of an investigation on the optical matching of the silicon solar cell system. The necessary formulae for reflection of light at normal and oblique incidence and the optimum conditions for elimination of reflection due to interference on thin layers are derived and applied to the solar cell system, taking into account the spectral distribution of outer space sunlight and the spectral response of silicon solar cells. Based on the measured output of an uncovered uncoated silicon cell the ideal output of a reflection-free solar cell is computed. If the calculated output of the ideal cell is set at 100% the output of the uncovered cell is only 62.5%, and that of an average SiO coated cell (measured) is approximately 80%. For both covered and uncovered solar cells the optimum $\lambda/4$ antireflection layer has been calculated with respect to layer thickness and refractive index and the optimum output values relating to the ideal cell output are given. A comparison of the computed output for covered cells coated with the optimum antireflection layer (n_L = 2.4 and layer thickness d = 625 Å) and that for cells coated with the usual SiO coating shows that a 6% output increase is possible if an optimal matched $\lambda/4$ layer is applied. The material of this layer must be compatible with the solar cell surface. Possible coating materials

with suitable refractive indices are discussed briefly. The computed output of a cell coated with an ideal SiO $\lambda/4$ antireflection layer adjusted in thickness to the optimum wavelength of 6000 Å is compared with the measured output of a SiO coated cell. From the fact that the measured value is about 12% lower than the calculated value, it can be concluded that because of the non-ideal flat surface of the cell, the thickness of the coating over the whole surface deviates either side of the optimum thickness, resulting in increased reflection. The discrepancy between calculated and measured data due to the roughness of the cell surface will be a common feature of all antireflection coatings. The possible improvement should not be affected by this discrepancy. SiO coatings show in addition an estimated output loss of 1% because of the absorption in the short-wavelength part of the visible region.
Author (ESRO)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N69-34607# Sandia Corp., Albuquerque, N. Mex.
DESIGN REQUIREMENTS FOR LAMINAR AIRFLOW CLEAN ROOMS AND DEVICES
K. F. Lindell, W. J. Whitfield, and D. M. Garst May 1969 55 p refs Sponsored by AEC
(SC-M-69-129) Avail: CFSTI

The basic concept of laminar airflow and the control of airborne contamination by this method are explained. Basic design criteria essential for the maximum performance of the various types of laminar airflow facilities are described and illustrated. An appendix provides a list of items useful in preparing a comprehensive clean room specification.
Author (NSA)

N69-34670*# Bellcomm, Inc., Washington, D.C.
ON THE POSSIBILITY OF EXOTIC BIOCHEMISTRIES
S. G. Schulman 17 Dec. 1968 30 p refs
(Contract NASw-417)
(NASA-CR-104095; TR-68-710-9) Avail: CFSTI CSCL 06A

The likelihood of abiogenesis and extraterrestrial life based upon chemical structures other than the usual proteins, nucleic acids, water and other organic molecules common to terrestrial biochemistry is examined. High cosmic abundance and small size are found to be desirable features of atoms comprising the large molecules of living systems. Polarity, abundance, and good solvating properties are found to be the requirements for a suitable biological solvent. It is concluded that hydrogen and the elements in the second row of the Periodic Table – namely carbon, nitrogen and oxygen, are necessary major components of biologically significant molecules, although some variation from the terrestrial biomolecules is possible under different pressure temperature and concentration conditions. Ammonia is found to be a possible replacement for water, as a biological solvent, under conditions where water is frozen but ammonia is a liquid.
Author

N69-34723# Electrotechnical Lab., Tokyo (Japan).
ANALYSIS OF THE EYE MOVEMENT SYSTEM
Noboru Sugie Nov. 1968 101 p refs In JAPANESE; ENGLISH summary *Its* Res. No. 693
Avail: CFSTI

Eye movement, induced solely by the visual input, is investigated using physiological and anatomical aspects. A theoretical attempt is made of predictive control of visual target tracking. Results agree reasonably well with predictions. Eye movement induced by head rotation, linear motion of the head, neck proprioceptive system and visual target tracking with active head movement are investigated. Results indicate eye movement is independent of other body movements and that movement is made up of a quick component for vision correction, and a slow component for velocity correction. Both humans and cats were used in the tests.
Author

N69-34751# Advisory Group for Aerospace Research and Development, Paris (France).
PATTERN RECOGNITION. BODY ARMOUR AND AIRCREW EQUIPMENT ASSEMBLIES. CURRENT SPACE MEDICAL PROBLEMS. AEROMEDICAL EVACUATION
Oct. 1968 262 p refs Proc. of the 25th Meeting of the Aerospace Med. Panel of AGARD Held in London, 15–17 Oct. 1968 (AGARD-CP-41) Avail: CFSTI

Areas of operational, military, and medical interest are discussed in terms of pattern recognition, body armor and aircrew equipment assemblies, aerospace medical problems, and aeromedical evacuation. For individual titles, see N69-34752 through N69-34780.

N69-34752# Royal Aircraft Establishment, Farnborough (England).
VISUAL THEORY IN TARGET ACQUISITION
E. B. Davies *In* AGARD Pattern Recognition. Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 14 p refs (See N69-34751 20-04)
Avail: CFSTI

The theoretical approach to visual search for a target based on the target's contrast and size and the concept of visual-lobes is reviewed briefly. New flight data for foveal contrast size thresholds, related to the maximum detection ranges of prominent terrain objects, are found to compare favorably with laboratory data from much simpler visual tasks. Two laboratory search experiments analyzed in terms of visual theory are shown to agree well with it, with little modification of the data used in the theory from certain selected but otherwise standard data. In particular, glimpse times of the order 1/3 to 2/3 seconds are found to be quite adequate to describe the experimental results.
Author

N69-34753# Nottingham Univ. (England). Dept. of Psychology.
TOWARDS A THEORY OF VISUAL SEARCH
C. I. Howarth and J. R. Bloomfield *In* AGARD Pattern Recognition. Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 14 p refs (See N69-34751 20-04)
Avail: CFSTI

As part of a larger research project into the nature of visual search, a simple, adaptable search task, in which subjects look for the odd disc in a display of larger or smaller discs, was devised. Extensive studies of well practiced observers, producing much basic search data, were carried out. A model was also constructed from basic search theory which is not definitive, but is mathematically simple, and, to some extent, accounts for the data found experimentally. However, there are some problems, and this is no more than a first step in a continuing effort to devise ways of predicting the range and latency of real targets from a physical specification of the target-background complex.
Author

N69-34754# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Aerospace Medical Div.
VARIABLES UNDERLYING THE RECOGNITION OF RANDOM SHAPES

Herbert J. Clark and Ronald L. Knoll (Antioch Coll.) *In* AGARD Pattern Recognition. Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 11 p refs (See N69-34751 20-04)
Avail: CFSTI

Previous studies showed that shape association value (percentage of subjects making an association to a shape) is a strong determining factor in shape recognition. In this study, the physical characteristics of shapes of high and low association value were compared. The intent was to uncover general physical characteristics of shape which differentiate shapes of high association value from shapes of low association value, and, thus, shapes accurately recognized from those not so accurately recognized. Comparisons were made on the basis of 12 factor scores per shape derived from an extensive analysis of 22 physical measures of shape. Results were that none of the factors differentiated between the two classes of shapes. Conclusions were that the physical measures may have been insensitive to perceptually conspicuous features in the perimeters of the shapes, and that associations to a shape are probably too varied in content to expect a few general physical measures to underlie those varied associations. Author

N69-34755# Aerospace Medicine Center, Rome (Italy).
PERCEPTION AND IDENTIFICATION OF SIMPLE IMAGES, PRESENTED IN DIFFERENT SEQUENCES, BY SUBJECTS SUBMITTED TO VARIOUS GRAVITATIONAL FIELDS
A. Scano, G. Meineri, and R. Caporale *In* AGARD Pattern Recognition. Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 11 p refs (See N69-34751 20-04)
Avail: CFSTI

Eleven normal, emmetropic subjects, known to be reliable, were used. While fixing the center of a perimeter with one eye, the subjects had to try to identify simple illuminated images, or at least to indicate the appearance of light. These simple images were located at 8°, 24°, 40°, 56° and 72° from the center, both on the right and left sides, and were illuminated for a brief time either in regular succession or random order. The subjects submitted to gravitational fields of +1Gz, +1.8Gz and +2.4Gz did not show any appreciable change in their undefined perception power or in their identification power of extra-foveal images, presented both in regular and random successions, as a consequence of different field intensity. The perception area of an undefined luminous message was distributed according to the well known shape of the monocular visual field. On the other hand, the area within which simple black and white images were identified was almost circular in shape and covered a surface which had a radius of about 20° centered on the fixation point. The method used demonstrated only a slight difference between the results obtained when the images in the visual field were presented in a regular or random sequence. Author

N69-34768# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
RESEARCH FINDINGS ON TARGET DETECTION THAT HAVE IMPLICATIONS FOR PATTERN RECOGNITION
Herschel C. Self *In* AGARD Pattern Recognition. Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 6 p refs (See N69-34751 20-04)
(AMRL-TR-68-156) Avail: CFSTI

The target-finding behavior of observers was examined using a variety of sensors and displays with static and moving scenes. Some of the numerous findings having implications for pattern recognition are discussed. It is pointed out that the detection-recognition dichotomy may be misleading: (1) that, within wide limits, contrast may influence reaction time more than it does probability of detection; (2) that either context or briefing may relegate resolution and contrast to minor roles; (3) that target finding is complicated by target-background interaction; and (4) that likely target locations reduce image quality requirements, while unlikely ones increase them. It follows that a priori search patterns can be inefficient, and that detection or recognition prediction models must be very complex to be useful. Finally, the antagonistic demands upon observer behavior of different performance goals are discussed. Author

N69-34768# School of Aerospace Medicine, Brooks AFB, Tex. Aerospace Medical Div.
CARDIOVASCULAR ASPECTS OF HYPODYNAMICS
Malcolm C. Lancaster *In* AGARD Pattern Recognition. Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 9 p refs (See N69-34751 20-04)
Avail: CFSTI

Exposure to inactivity produces a gradual decrease in cardiac stroke volume and a rise in resting pulse rate. There is also a decrease in oxygen transport capability. These changes, combined with a decrease in plasma volume and red cell mass and a loss of skeletal muscle, produce a significant decrease in work capacity which fails to completely return during three weeks ambulation. Prevention of this deconditioning by exercise during bed rest appears to be feasible and is being studied. Orthostatic intolerance resulting from bed rest was not obviated by restoration of plasma volume using drugs but can be obviated by exposure to lower body negative pressure during the final few days of bed rest. Decreased sympathetic nervous activity appears to be a factor in producing this intolerance but other factors may be important. Unlike the decreased work capacity, orthostatic tolerance tends to be restored within 48 to 72 hours of ambulation. Author

N69-34769# Air Force Systems Command, Brooks AFB, Tex.
THE METABOLIC AND HEMATOLOGIC ASPECTS OF HYPODYNAMICS
J. H. Triebwasser *In* AGARD Pattern Recognition. Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 16 p refs (See N69-34751 20-04)
Avail: CFSTI

The metabolic and hematologic consequences of prolonged bed rest are correlated to those observed and postulated in weightlessness. Some are a result of a change in level of activity, and others are secondary to a change in posture. The caloric requirement and metabolic rate decreases. The nitrogen, sulfur, and potassium balances become negative. Their ratio indicates depletion of muscle mass. The calculated total muscle mass loss over a six week period is approximately 1.7 kilograms. However, the body weight remains constant at the expense of increased adipose tissue formation. There is a progressive increase in urinary calcium excretion during bed rest which is independent of the calcium intake. In addition to a decrease in plasma volume, there is a reduction in the red cell mass. Ferrokinetic studies, as well as other tests, suggest decreased red cell production during bed rest. During recovery a further decrease is noted. Several studies suggest hemolysis as an explanation for this observation. Cortisol production and its diurnal variation is not appreciably altered. Author

N69-34770# Royal Air Force, Farnborough (England). Inst. of Aviation Medicine.
OBSERVATIONS ON THE GAS TENSIONS OF MIXED VENOUS BLOOD IN MAN

D. M. Denison *In* AGARD Pattern Recognition. Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 5 p refs (See N69-34751 20-04)
Avail: CFSTI

Mixed venous gas tensions have not been measured frequently in the past. Modern instruments have made it easier to do so. This small series of observations, made over a wide range of conditions, suggests that a rebreathing technique can measure them and that they behave in the way expected if in vitro dissociation curves were to apply in vivo. Experiments completed since the presentation have shown that: (1) The method can be applied to the study of exercise during total water immersion. (2) A complex relationship exists between the CO_2 tensions of pulmonary artery blood and rebreathed gas, although their oxygen tensions are identical. Author

N69-34771# Naval Air Development Center, Johnsville, Pa. Aerospace Medical Research Dept.
THE EFFECTS OF PROLONGED EXPOSURE TO HIGH OXYGEN TENSION
George H. Kydd *In* AGARD Pattern Recognition. Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 8 p refs (See N69-34751 20-04)
Avail: CFSTI

The effects as manifested in rats during up to 47 days of exposure, but principally at 30 days, were studied. These experiments were carried out at a pressure that is high but just short of that capable of producing terminal edema (2/3 atmosphere). Under these conditions, rats developed changes in the pulmonary vasculature that appeared to be hypertrophic and in some cases hyperplastic that suggested a greater turnover of tissue in the vessels. Further investigation showed that the rats developed pulmonary hypertension and systemic hypotension. In view of the vascular changes, these effects are attributed to an increased vascular resistance and a decreased cardiac output from the right heart. The long term significance of these effects have not been studied, but it is suggested that they would be ameliorated by return to air breathing. Author

N69-34773# Centre d'Enseignement et de Recherches de Medecine Aeronautique, Paris (France).
INFLUENCE OF MAGNETIC FIELD VARIATIONS ON THE GROWTH OF CERTAIN MICROORGANISMS [INFLUENCE DES VARIATIONS D'UN CHAMP MAGNETIQUE SUR LA CROISSANCE DE CERTAINS MICRO-ORGANISMES]
L. Miro, G. Deltour, and A. Pfister *In* AGARD Pattern Recognition. Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 7 p In FRENCH (See N69-34751 20-04)
Avail: CFSTI

Three series of experiments placing growing *Escherischie coli* cultures in the presence of varying levels of magnetic field influence are reported. In a magnetic field of 42,000 gauss, no appreciable change in growth rate was determined; however, differences of metabolic output were provoked after each variation, and sudden increases in growth rates according to the number of viable cells counted. Daughter cells produced during this period were considered to be polynuclear and to have inferior nuclear structures to the mother bacteria. Trans. by M.H.E.

N69-34774# Royal Air Force, Farnborough (England).
AEROMEDICAL EVACUATION
D. W. Atkinson *In* AGARD Pattern Recognition. Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 10 p (See N69-34751 20-04)
Avail: CFSTI

Aircraft flown on RAF scheduled aeromedical flights from Singapore, Bahrein, and Germany, as well as those used for the UK internal flights, are described. The problems of non-scheduled flights, communications, and certain medical categories involved are mentioned. Equipment is briefly described. Aeromedical evacuation units were developed for tactical operational use which are self-contained in personnel and equipment including transport. Author

N69-34775# Duesseldorf Univ. (West Germany). Univ. Hospitals.
EXPERIENCES IN AIR TRANSPORT OF PATIENTS IN PEACE TIME
Roger Ney *In* AGARD Pattern Recognition. Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 5 p (See N69-34751 20-04)
Avail: CFSTI

Thirty-five helicopter emergency evacuation missions in Germany are summarized, including advantages, future possibilities for use, and limitations of such techniques. Medical requirements are treated, as well as possible effects of low level flying. Cost considerations are also taken into account. Author

N69-34776# Naval Air Systems Command, Washington, D.C.
AEROMEDICAL PROBLEMS IN THE RESCUE OF DOWNED AIRMEN
Roland A. Bosee and James F. Parker, Jr. (BioTechnology, Inc.) *In* AGARD Pattern Recognition. Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 8 p (See N69-34751 20-04)
Avail: CFSTI

Aeromedical problems arising during the rescue of downed airmen under combat conditions and the need for new or improved rescue equipment and techniques are discussed. Interviews were conducted with medical personnel and rescue teams recently returned from Southeast Asia. A total of 42 rescues was studied. Information was obtained concerning the rescue and medical support equipment used, rescue techniques employed, type and frequency of survivor injuries, and problems encountered during rescue operations. Results show the range of injuries sustained by aircrew personnel under combat conditions dictates the need for certain classes of medical support equipment to be carried in rescue vehicles and specific training to be given to helicopter rescue crewmen. The injury classes include: (1) serious loss of blood from lacerations caused by penetrating shell fragments, (2) spinal fractures and severe cervical strains, (3) fractures of one or more extremities, and (4) shock. The equipment carried and the training of rescue crewmen must be appropriate for these injuries. Author

N69-34777# Air Force Systems Command, Brooks AFB, Tex. Aerospace Medicine Div.
RECENT ADVANCES AND NEW CONCEPTS IN THE AIR EVACUATION OF PATIENTS IN CARGO TYPE AIRCRAFT
John E. Murphy *In* AGARD Pattern Recognition. Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 11 p refs (See N69-34751 20-04)
Avail: CFSTI

Recent advances in the development of medical equipment have provided for the capability to safely and comfortably move sick and wounded casualties in multi-mission cargo-type aircraft. The requirement for reduced weight and bulk inherent in the air

transport mode has led to many innovations and adaptations in equipment. Equipment has been developed to facilitate the reconfiguration into an air evacuation mode in less than one hour, so that casualties may be evacuated by the same aircraft that delivers supplies to forward area airheads. Special medical equipment has been designed for use in the several multi-mission aircraft (C-7, C-123, C-130, C-141) that perform short-range tactical missions. On long range aeromedical evacuation missions, a special care unit is presently being developed to enable seriously ill patients to be moved over long distances when adequate medical capability is not available at the originating site. Described are methods for the rapid conversion of cargo aircraft into the aeromedical evacuation role. Also presented are the contributions of specialized medical equipment to transport casualties in cargo-type aircraft for both the Tactical and Strategic Aeromedical Evacuation. Author

N69-34778# Air Force Systems Command, Brooks AFB, Tex. Aerospace Medical Div.
MEDICAL CONSIDERATIONS AFFECTING EARLY AIR EVACUATION OF THE SERIOUSLY ILL PATIENT
Robert C. McIver and John E. Murphy *In* AGARD Pattern Recognition. Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 5 p (See N69-34751 20-04)
Avail: CFSTI

Evacuations of seriously ill or injured patients, both before and after definitive medical care has been administered, is discussed and evaluated. It is concluded that such patients can be transported by air with greatest chance of survival if their condition has been stabilized from a cardiovascular, respiratory, and renal standpoint prior to flight. Frequent gravitational changes, turbulence, partial reduction in oxygen pressure, dry air, and crowded conditions are among the most frequent conditions which affect the patient's safety. Proper guidelines for controlling these situations, however, can be established. Author

N69-34779# Air Force Systems Command, Brooks AFB, Tex. Aerospace Medical Div.
RESEARCH AND DEVELOPMENT IN SUPPORT OF AEROMEDICAL EVACUATION
Fritz M. G. Holmstrom, Virginia M. Alena, and Lynn B. Rowe *In* AGARD Pattern Recognition. Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 13 p (See N69-34751 20-04)
Avail: CFSTI

The primary objectives of the USAF research and development program to improve inflight patient care are presented and certain related efforts summarized. The logic of these efforts as part of an orderly integrated developmental program designed to advance both theory, equipment and practices is touched upon. The continuing requirement to identify, in advance of the need, the kind of research and development that should be undertaken now in order to take advantage of the potential that will be offered by future advanced aircraft systems remains as an underlying theme. Author

N69-34780# Headquarters Army Aviation, Middle Wallop (England).
A LIGHTWEIGHT PLASTIC LITTER
I. C. Perry *In* AGARD Pattern Recognition. Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 12 p (See N69-34751 20-04)
Avail: CFSTI

The arguments for such a piece of equipment are put forward, and some arguments against it are given. The idea of a simple molded plastic litter to replace conventional poles with something strong between them is not easy to accept after so many years getting the general stretcher perfected. However, the stretcher is not desired by the aircraft designers, as it is too long, cumbersome, heavy, and always presents problems. It is suggested, therefore, that a change is definitely required. Author

N69-34784# California Univ., Berkeley. Lawrence Radiation Lab.
CHEMICAL BIODYNAMICS Annual Report, 1967
Melvin Calvin et al 1 Jun. 1968 134 p refs
(Contract W-7405-ENG-48)
(UCRL-18216) Avail: CFSTI

CONTENTS:
1. ANIMAL, PLANT, AND BACTERIAL BIOCHEMISTRY p 1–43 refs (See N69-34785 20-04)
2. BIOPHYSICAL CHEMISTRY AND BIOPHYSICS p 45–80 refs (See N69-34786 20-04)
3. ORGANIC CHEMISTRY AND GEOCHEMISTRY p 81–98 refs (See N69-34787 20-06)
4. PHOTOCHEMISTRY AND RADIATION CHEMISTRY p 99–112 refs (See N69-34788 20-06)

N69-34785# California Univ., Berkeley. Lawrence Radiation Lab.
ANIMAL, PLANT, AND BACTERIAL BIOCHEMISTRY
In its Chem. Biodyn. 1 Jun. 1968 p 1–43 refs (See N69-34784 20-04)
Avail: CFSTI

The effects of differential enriched or impoverished experiences on brain measurements in rats are described, and the biosynthesis of opium alkaloids thebaine and of nicotine are discussed. A study of the dynamic metabolic regulation of the photosynthetic carbon reduction cycle is presented. F.O.S.

N69-34786# California Univ., Berkeley. Lawrence Radiation Lab.
BIOPHYSICAL CHEMISTRY AND BIOPHYSICS
In its Chem. Biodyn. 1 Jun. 1968 p 45–80 refs (See N69-34784 20-04)
Avail: CFSTI

The research in biophysical chemistry and biophysics is reported. Subjects covered are: (1) ribonucleic acid structure, (2) hydration of DNA, (3) polymer dynamics, (4) chlorophyll interactions, (5) light reactions in spinach chloroplasts, (6) excitation transfer by chlorophyll, (7) EPR signal in *Rhodospirillum rubrum*, (8) spin-lattice relaxation, and (9) autoradiography of tritium on chromatograms. F.O.S.

N69-34826# Joint Publications Research Service, Washington, D.C.
SPACE BIOLOGY AND MEDICINE, VOLUME 3, NO. 2, 1969
15 Jul. 1969 128 p refs Transl. into ENGLISH of the periodical "Kosmicheskaya Biologiya i Meditsina" v. 3, no. 2 Moscow, Meditsina Publishing House, 1969 p 3–77
(JPRS-48416) Avail: CFSTI

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2. EFFECT OF THE ALCOHOL-SOLUBLE FRACTION OF A BIOMASS OF PROTOCOCCAL ALGAE ON WHITE RATS A. V. Novikova et al p 11–15 refs (See N69-34828 20-04)
3. PROTECTIVE EFFECT OF ANTIHYPOXIC DRUGS DURING GRAVITATIONAL ACCELERATIONS V. M. Vinogradov et al p 16–21 refs (See N69-34829 20-04)

4. SOME METABOLIC INDICES OF ANIMALS DURING PROLONGED EXPOSURE TO A HYPEROXIC ATMOSPHERE WITH NITROGEN OR HELIUM A. G. Zhironkin et al p 22–28 refs (See N69-34830 20-04)

5. GAS EXCHANGE OF SOME VEGETABLES IN A HYPEROXIC ATMOSPHERE N. T. Nilovskaya p 29–36 refs (See N69-34831 20-04)

6. PECULIARITIES OF VESTIBULAR REACTIONS OF RATS EXPOSED TO ARTIFICIAL HYPOTHERMIA I. I. Voinova et al p 37–44 refs (See N69-34832 20-04)

7. CIRCADIAN RHYTHMS OF PHYSIOLOGICAL FUNCTIONS IN FLIGHT PERSONNEL A. V. Chapek p 45–52 refs (See N69-34833 20-04)

8. EFFECT OF ALTERNATING WORK AND REST CYCLES ON THE HUMAN BODY IN ISOLATED ENVIRONMENTS B. A. Dushkov et al p 53–62 refs (See N69-34834 20-04)

9. CHANGE IN PRECISE MOVEMENTS IN PERSONS WITH DIFFERENT PHYSICAL FITNESS WHEN EXPOSED TO HYPOKINESIA A. A. Korobova et al p 63–70 refs (See N69-34835 20-04)

10. COORDINATION OF HUMAN MOVEMENTS DURING ALTERNATING EXPOSURE TO ACCELERATIONS AND WEIGHTLESSNESS M. A. Cherepakhin p 71–76 refs (See N69-34836 20-04)

11. EFFECT OF LONG-TERM HYPOKINESIA ON HUMAN TOLERANCE TO PHYSICAL STRESS B. S. Katkovskiy et al p 77–85 refs (See N69-34837 20-04)

12. USE OF A TWO-GAS ARTIFICIAL ATMOSPHERE IN MANNED SPACESHIPS E. V. Bondarev et al p 86–93 (See N69-34838 20-04)

13. A METHOD FOR MEASURING PHYSIOLOGICAL INDICES USING AN ELECTRONIC COMPUTER A. P. Kalinovskiy p 94–101 refs (See N69-34839 20-04)

14. PHAGOCYTIC ACTIVITY AND CARBOHYDRATE METABOLISM OF NEUTROPHILS IN HUMANS EXPOSED TO HYPEROXIC ATMOSPHERES A. S. Kaplanskiy et al p 102–107 refs (See N69-34840 20-04)

15. CONVEYER CULTIVATION OF CARROTS BY THE AEROPONICS METHOD Ye. V. Lebedeva et al p 108–110 (See N69-34841 20-04)

16. APPEARANCE OF CHROMOSOMAL REARRANGEMENTS IN THE EPITHELIUM OF THE CORNEA OF MICE DURING GENERAL PROLONGED GAMMA IRRADIATION T. M. Zukhbaya et al p 111–113 refs (See N69-34842 20-04)

17. REVIEW OF *PROBLEMS IN SPACE MEDICINE*, VOLUME 6 I. M. Khazen et al p 114–119 (See N69-34843 20-04)

N69-34827# Joint Publications Research Service, Washington, D.C.

MYOCARDIAL CHANGES IN RABBITS FOLLOWING THEIR CHRONIC WHOLE-BODY IRRADIATION (KARYOMETRIC DATA)

Ye. I. Vorbyev et al *In its* Space Biol. and Med., Vol. 3, No. 2, 1969 15 Jul. 1969 p 1–10 refs (See N69-34826 20-04)
Avail: CFSTI

The animals were subjected to whole body irradiation with a dose of 20 R/day, receiving a total dose of 500, 1500 and 2400 R. The tissue changes were evaluated using histologic and karyometric techniques. On the tenth day after irradiation with any of the doses, there was a decrease in the size of muscular nuclei against a background of interstitial edema, vascular hyperemia and dystrophically changed muscle fibers. The decrease persisted for three to six months after the exposure. The development of myofibrosis in the myocardium was accompanied by the formation of muscle fibers with large and gigantic cells. This can be considered a manifestation of compensation and repair processes in the myocardium. Author

N69-34828# Joint Publications Research Service, Washington, D.C.

EFFECT OF THE ALCOHOL-SOLUBLE FRACTION OF A BIOMASS OF PROTOCOCCAL ALGAE ON WHITE RATS

A. V. Novikova et al *In its* Space Biol. and Med., vol. 3, no.2, 1969 15 Jul. 1969 p 11–15 refs (See N69-37826 20-04)
Avail: CFSTI

Experiments were carried out on 40 white male rats to determine the effect from feeding the animals with an alcohol-soluble fraction of protococcal algae. The diet included alcohol-bleached and unbleached biomasses of Chlorella and Scenedesmus. The animals fed with an unbleached biomass displayed a decrease in body weight and an increase in adrenal weight. Upon a histological examination they also exhibited certain changes in the adrenal cortex and glomerules. Author

N69-34829# Joint Publications Research Service, Washington, D.C.

PROTECTIVE EFFECT OF ANTIHYPOXIC DRUGS DURING GRAVITATIONAL ACCELERATIONS

V. M. Vinogradov et al *In its* Space Biol. and Med., vol. 3, no. 2, 1969 15 Jul. 1969 p 16–21 refs (See N69-34826 20-04)
Avail: CFSTI

The protective effect of substances with antihypoxic properties was studied using thiorea and gutimine derivatives. Experiments were conducted on more than 1500 white mice and 250 rats which were placed in holders of a redesigned centrifuge with a precisely calibrated tachometer. Most observations were made with gutimine at various doses and during different stages of acceleration. Results indicated nearly complete cerebral and cardiac anoxia of short duration (90 sec), well below human tolerances. It was therefore concluded that antihypoxic drugs show promise in protecting the body against brief, lethal accelerations, possibly in combination with simultaneous use of other substances whose positive influence under these conditions has already been demonstrated. A.C.R.

N69-34830# Joint Publications Research Service, Washington, D.C.

SOME METABOLIC INDICES OF ANIMALS DURING PROLONGED EXPOSURE TO A HYPEROXIC ATMOSPHERE WITH NITROGEN OR HELIUM

A. G. Zhironkin et al *In its* Space Biol. and Med., vol. 3, no. 2, 1969 15 Jul. 1969 p 22–28 refs (See N69-34826 20-04)
Avail: CFSTI

A nine-day experiment was carried out to study changes in the oxygen consumption and rectal temperature of mice exposed to a 80% oxygen atmosphere containing nitrogen or helium as diluents. The results suggest that an increased oxygen concentration is the crucial factor influencing the gas exchange and body temperature of animals exposed to a hyperoxic atmosphere with either nitrogen or helium. The studied variables decreased in both gas mixtures. However, in the helium-oxygen atmosphere a reduction of the oxygen consumption occurred later, and the drop in rectal temperature was less pronounced than in the nitrogen-oxygen atmosphere. Author

N69-34831# Joint Publications Research Service, Washington, D.C.

GAS EXCHANGE OF SOME VEGETABLES IN A HYPEROXIC ATMOSPHERE

N. T. Nilovskaya *In its* Space Biol. and Med., vol. 3, no. 2, 1969 15 Jul. 1969 p 29–36 refs (See N69-34826 20-04)
Avail: CFSTI

The intensity of photosynthesis and respiration of vegetables which appear appropriate for growth in space hot-houses (potatoes, beets, common and Chinese cabbage) was investigated in atmospheres with different oxygen (160–372 mm Hg) and

carbon dioxide (0.76-3.8 mm Hg) partial pressures under various illumination conditions (50–200 W/m^2). An increase in oxygen partial pressure in the atmosphere over 160 mm Hg reduced the photosynthetic activity of plants, simultaneously increasing their night respiration. The effect of oxygen on plant gas exchange depended on its concentration and the plant species. With a decrease in radiant energy, the inhibitory effect of the increased oxygen concentrations on photosynthesis increased significantly. A reduction of the carbon dioxide partial pressure in the atmosphere produced a similar effect. Author

N69-34832# Joint Publications Research Service, Washington, D.C.

PECULIARITIES OF VESTIBULAR REACTIONS OF RATS EXPOSED TO ARTIFICIAL HYPOTHERMIA

I. I. Voinova et al *In its* Space Biol. and Med., vol. 3, no. 2, 1969 15 Jul. 1969 p 37–44 refs (See N69-34826 20-04)
Avail: CFSTI

Peculiarities of the vestibular function of animals exposed to artificial hypothermia induced by various techniques were investigated in 34 rats. Upon exposure to angular accelerations, the rectal temperature of the animals was reduced to 32–30°; use of the hypercapnia-hypoxia technique revealed an increase in the duration and number of beats of the post-rotational nystagmus and an increase in respiration rate. With a further cooling of rats to 27–20°, the indices gradually decreased. The animals were cooled to a hypothermic state using premedication with promedol and pipolfen, and there was a continuous decrease in the nystagmic reaction at every stage of their cooling. The vestibular reflexes disappeared at a body temperature of 21°C brought about by both techniques. The variations seen in the development of vestibular reactions of the cooled animals can be attributed to a gradual inhibition of the central nervous system occurring in the descending direction. The changes in the main cortical processes during early stages of hypothermia primarily affected the relationship between the level of vestibular stimulation and response. Author

N69-34833# Joint Publications Research Service, Washington, D.C.

CIRCADIAN RHYTHMS OF PHYSIOLOGICAL FUNCTIONS IN FLIGHT PERSONNEL

A. V. Chapek *In its* Space Biol. and Med., vol. 3, no. 2, 1969 15 Jul. 1969 p 45–52 refs (See N69-34826 20-04)
Avail: CFSTI

Circadian rhythms of physiological functions of pilots travelling through six or more time zones during the daytime and nighttime were studied. The biological rhythms of physiological functions were concordant with the time zone of their permanent residence. The lowest indices of physiological functions were recorded at 0400 hours, whereas the highest were noted between 1600 and 2000 hours. The functions of the central nervous system, optical and cardiovascular systems decreased as a result of night flights made between 2300 and 0500 hours. Author

N69-34834# Joint Publications Research Service, Washington, D.C.

EFFECT OF ALTERNATING WORK AND REST CYCLES ON THE HUMAN BODY IN ISOLATED ENVIRONMENTS

B. A. Dushkov et al *In its* Space Biol. and Med., Vol. 3, No. 2, 1969 15 Jul. 1969 p 53–62 refs (See N69-34826 20-04)
Avail: CFSTI

The performance and behavior of two well-selected groups of six test subjects (two shifts) restricted to a small chamber were studied during four seven-day experiments. The test subjects adhered to an alternating daily routine of six-hour work and rest cycles (including four hours of sleep), performing various mental and physical tasks. The duration of the sleep and wakefulness cycles was similar in both groups. However, test subjects in the second group spent 72% of their working hours on physical exercises, mental work and training, whereas those in the first group spent only 5.5% of their time on these tasks. The functional state and performance of the test subjects were evaluated by comprehensive studies including physiological, psycological and biochemical tests. The test subjects of the first shift showed impairment of their functional state and performance level. The test subjects of the second shift exhibited good mental and physical performance throughout the experiment. This can be attributed to a favorable effect of physical exercises, functional music, vitamins and physiological stimulation used in accordance with the Kekcheyev method. Author

N69-34835# Joint Publications Research Service, Washington, D.C.

CHANGE IN PRECISE MOVEMENTS IN PERSONS WITH DIFFERENT PHYSICAL FITNESS WHEN EXPOSED TO HYPOKINESIA

A. A. Korobova et al *In its* Space Biol. and Med., vol. 3, no. 2, 1969 15 Jul. 1969 p 63–70 refs (See N69-34826 20-04)
Avail: CFSTI

Changes in the coordination of athletes (runners and weight lifters) exposed to a 40-day bedrest were investigated by the method of vector-operation dynamography. The tests were conducted before and after exercises (performed with a limited load with a bicycle-type erogometer and with a maximum load with a treadmill). A decrease in motor activity resulted in insignificant changes in the level of total error. Use of exercises of the two types helped to reveal qualitative differences (predominance of positive efforts) in the performance of the task. Author

N69-34836# Joint Publications Research Service, Washington, D.C.

COORDINATION OF HUMAN MOVEMENTS DURING ALTERNATING EXPOSURE TO ACCELERATIONS AND WEIGHTLESSNESS

M. A. Cherepakhin *In its* Space Biol. and Med., Vol. 3, No. 2, 1969 15 Jul. 1969 p 71–76 refs (See N69-34826 20-04)
Avail: CFSTI

Human motor coordination was studied during jet flights in a Keplerian trajectory. The test subjects had no experience in performing flights during weightlessness. During exposure to weightlessness or accelerations the test subject pressed the rigid surface of a tensometric dynamometer, the second effort being twice as weak as the first one. The mechanogram and accelerogram were simultaneously recorded by an oscillograph. During the early exposures the trained motor habit was disturbed, but with repeated flights the disturbances gradually disappeared. The effect of weightlessness on motor activity, on the one hand, involved the influence of zero gravity as such and, on the other, the effect of a novel factor inherent in any unusual environment. The change in body weight and the primary characteristics of the motor habit varied in conformity with motor perseverance, the latter constituting a disorder in motor coordination. The weightlessness state produced an increase in muscular tension at an early period of the exposure. Author

N69-34837# Joint Publications Research Service, Washington, D.C.

EFFECT OF LONG-TERM HYPOKINESIA ON HUMAN TOLERANCE TO PHYSICAL STRESS

B. S. Katkovskiy et al *In its* Space Biol. and Med., vol. 3, no. 2, 1969 15 Jul. 1969 p 77–85 refs (See N69-34827 20-04)
Avail: CFSTI

A 62-day bedrest experiment was performed on six healthy male test subjects. During the experiment an attempt was made to maintain high performance of three test subjects (first group) using physical exercises which compensated for their muscular inactivity (with respect to metabolic rates). The motor activity of the resting subjects (second group) was minimized. After the bedrest experience the tolerance of the members of the second group to physical work decreased, whereas the members of the first group retained tolerance to both moderate and heavy work. The experimental findings suggest that deterioration of the performance level of human subjects subjected to bedrest is due to hypokinesia.
Author

N69-34838# Joint Publications Research Service, Washington, D.C.

USE OF A TWO-GAS ARTIFICIAL ATMOSPHERE IN MANNED SPACESHIPS

E. V. Bondarev et al *In its* Space Bio. and Med., Vol. 3, No. 2, 1969 15 Jul. 1969 p 86–93 (See N69-34826 20-04)
Avail: CFSTI

Experiments were conducted to investigate the development of decompression sickness occurring in humans upon their transition from a nitrogen–oxygen atmosphere, with a total pressure of 400 mm Hg, to an oxygen atmosphere, with a pressure of 170 mm Hg. To a certain extent this simulates the decompression from a spaceship cabin environment to suit atmosphere during extravehicular activity. No subjective complaints or objective symptoms peculiar to various forms of decompression sickness were recorded. This suggests that the two-gas mixture assessed in the experiment can be successfully used in space missions involving suited extravehicular operations.
Author

N69-34839# Joint Publications Research Service, Washington, D.C.

A METHOD FOR MEASURING PHYSIOLOGICAL INDICES USING AN ELECTRONIC COMPUTER

A. P. Kalinovskiy *In its* Space Biol. and Med., Vol. 3, No. 2, 1969 15 Jul. 1969 p 94–101 refs (See N69-34826 20-04)
Avail: CFSTI

A computer-aided interpolation technique specifically applicable for physiological data analysis is described. The technique is based on the computation of the coordinates of points of individual functions as the intersection of two straight lines which interpolate the function between the point to be defined and adjacent sampling points on the right and left respectively. In addition to the essential simplicity of the computation procedure, the technique ensures sufficient accuracy in physiological measurements.
Author

N69-34840# Joint Publications Research Service, Washington, D.C.

PHAGOCYTIC ACTIVITY AND CARBOHYDRATE METABOLISM OF NEUTROPHILS IN HUMANS EXPOSED TO HYPEROXIC ATMOSPHERES

A. S. Kaplenskiy et al *In its* Space Biol. and Med., Vol. 3, No. 2, 1969 15 Jul. 1969 p 102–107 refs (See N69-34826 20-04)
Avail: CFSTI

Four healthy male volunteers were used, two of whom were exposed for ten days in a 53% O_2 atmosphere, whereas the other two were exposed for 14 days to a 40% O_2 atmosphere. It was found that an increase in the oxygen concentration in the breathed air resulted in reduced phagocytic activity of neutrophils in the peripheral blood. In addition, it was demonstrated cytochemically that the glycogen content in the neutrophils remained unaltered, whereas the activity of phosphorylase and UDPG-glycogen synthetase decreased slightly. The relationship between energy metabolism and the function of the neutrophils is discussed. It was found that the toxic effect of oxygen manifests itself at a concentration of 40% in the breathing air and that human individual sensitivity to oxygen varies greatly.
Author

N69-34841# Joint Publications Research Service, Washington, D.C.

CONVEYER CULTIVATION OF CARROTS BY THE AEROPONICS METHOD

Ye. V. Lebedeva et al *In its* Space Biol. and Med., Vol. 3, No. 2, 1969 15 Jul. 1969 p 108–110 (See N69-34826 20-04)
Avail: CFSTI

An evaluation of the possibility of cultivating root vegetables by the aeroponics method is made. The investigated object was carrots of the Nantskaya variety, which in the human diet serve as a basic source of carotine (provitamin A). Carrots were cultivated in a non-air conditioned room, where air temperature and humidity were not regulated. Daily yield from the method is given, as well as tabulated data on the chemical composition determined from 19 yields.
Author

N69-34842# Joint Publications Research Service, Washington, D.C.

APPEARANCE OF CHROMOSOMAL REARRANGEMENTS IN THE EPITHELIUM OF THE CORNEA OF MICE DURING GENERAL PROLONGED GAMMA IRRADIATION

Zukhbaya et al *In its* Space Biol. and Med., Vol. 3, No. 2, 1969 15 Jul. 1969 p 111–113 refs (See N69-34826 20-04)
Avail: CFSTI

In relation to the effect of acute irradiations on the animal body, the influence of single general gamma radiation at varying dosages on the appearance of chromosomal rearrangements was studied. These changes were compared with the level of damage to the entire body. Used were 350 white, nonlinear, sexually mature mice of both sexes weighing 16–20 g. Ninety experimental mice formed a control group, and the other 260 were divided into eight groups. All the animals, other than the control mice, were irradiated with Co^{60} gamma rays. Data on the irradiation regimes are given in the table.
Author

N69-34843# Joint Publications Research Service, Washington, D.C.

REVIEW OF PROBLEMS IN SPACE MEDICINE, VOLUME 8

I. M. Khazen et al *In its* Space Biol. and Med., Vol. 3, No. 2, 1969 15 Jul. 1969 p 114–119 (See N69-34826 20-04)
Avail: CFSTI

Recent research into the problems of space biology, particularly those associated with gravitational effects of various types, is reviewed. Emphasis is placed on studies of hypodynamia, physiological responses to transverse acceleration, influence of acceleration on the cardiovascular system, and effects of shock acceleration. Methodological approaches, as well as tests using animals as subjects, are also mentioned.
A.C.R.

N69-34866*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

HYPERTENSION AND DIPSOTHERAPY [HYPERTONIE UND DURSTKUREN]

Heinz Strauss Washington NASA Aug. 1969 5 p refs Transl. into ENGLISH from Z. Urol. (Leipzig), v. 22, 1928 p 691–693 (Contract NASw-1692)

(NASA-TT-F-12506) Avail: CFSTI CSCL 06D

Survey of therapeutic approaches to hypertension involving adjustments of fluid intake is presented. The then-current (1927) literature on the subject and attempts to consider casual relationships between fluid intake and hypertension is surveyed. Author

N69-34879*# Department of Agriculture, Washington, D.C. Natural Resource Economics Div.

AN EVALUATION OF CROP AND LAND USE DATA IN A WORLD SAMPLE OF COUNTRIES

Simon Baker Nov. 1968 25 p refs (NASA Order R-09-038-002)

(NASA-CR-103944) Avail: CFSTI CSCL 02B

The main objective of this study was to provide information useful in determining how, and to what extent, remote sensing might help in supplying more accurate, comprehensive, and timely data on crop areas, crop yields, crop production, and land use around the world. Remote sensing is the method used to collect such data about the earth's surface. This method utilized optical, electro-optical, and electronic devices mounted in airplanes or satellites. Remote sensing promises to close some of the remaining gaps in available data, and to improve data quality and timeliness. It may be possible, through remote sensing, to replace some present methods with less costly methods. Author

N69-34883*# Bellcomm, Inc., Washington, D.C.

BIOLOGICAL GENERALIZATIONS AND THE SEARCH FOR EXTRATERRESTRIAL LIFE

D. B. Hoffman and A. N. Kontaratos 22 Jan. 1969 55 p refs (Contract NASw-417)

(NASA-CR-104060; TR-69-710-1) Avail: CFSTI CSCL 06C

A framework for a systematic approach to the search for extraterrestrial life is provided. Possible universal attributes of life are derived from inferences based on the functional characteristics, the material building blocks, the levels of organization, and the origin and evolution of terrestrial life. These generalizations are divided into hereditary, morphological, metabolic, and ecological categories and, like other scientific hypotheses, are subject to refinement and change. Some limitations of operational approaches to the search for extraterrestrial life are identified. Working assumptions are then developed to allow definition of appropriate tests within these limitations. This information is in turn used to establish criteria barring the existence of life, criteria suggesting the possible existence of life, and criteria confirming the existence of life. Author

N69-34943# California Univ., Livermore. Lawrence Radiation Lab.

FIELD INSTRUMENT FOR PLUTONIUM FECAL SAMPLE ANALYSIS

W. P. Bennett, J. F. Tinney and J. L. Cate *In its* Hazards Control, No. 31 Aug. 1969 p 31–34 (See N69-34938 20-14)

Avail: CFSTI

Sample collection techniques, sample preparation, a prototype fecal sample monitor, and calibration results using known concentrations of plutonium and americium in water are described. NSA

N69-34947# California Univ., Livermore. Lawrence Radiation Lab.

AN EVALUATION OF X-RAY FLUORESCENCE FOR *IN VIVO* BIOLOGICAL STUDIES

J. F. Tinney and J. L. Cate *In its* Hazards Control, No. 31 Aug. 1968 p 51–58 (See N69-34938 20-14)

Avail: CFSTI

Some preliminary results are reported in a research program to theoretically and experimentally determine the feasibility of using fluorescent X rays for in vivo biological studies. Author (NSA)

N69-35025# Ohio State Univ., Columbus. Computer and Information Science Research Center.

REACTION TIME AND UNCERTAINTY IN HUMAN INFORMATION PROCESSING

George E. Briggs Mar. 1969 41 p refs (Grant NSF GN-534)

(PB-184135; CISRC-TR-69-5) Avail: CFSTI

Content: Hight-speed scanning of random figures in human memory: Retrieval time as a function of memory ensemble size: Information processing as a function of speed versus accuracy: Memory retrieval and central comparison times in information processing. USGRDR

N69-35135*# Chicago Univ., Ill.

INVESTIGATION IN SPACE-RELATED MOLECULAR BIOLOGY INCLUDING CONSIDERATIONS OF THE MOLECULAR ORGANIZATION IN LUSTER SOUNDING ROCKET PROGRAM Progress Report, 1 Jan. 1968–31 Aug. 1969

Humberto Fernandez-Moran 31 Aug. 1969 226 p refs (Grant NGL-14-001-012)

Avail: CFSTI CSCL 06C

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1. RESEARCH AND TRAINING PROGRAM IN SPACE-MOLECULAR BIOLOGY CONDUCTED AT FACILITIES FOR HIGH RESOLUTION ELECTRON MICROSCOPY 95 p refs (See N69-35136 20-04)

2. ELECTRON MICROSCOPY OF DNA CONFORMATIONS IN SPINACH CHLOROPLASTS C. L. F. Woodcock and H. Fernandez-Moran 9 p refs (See N69-35137 20-04)

3. ULTRASTRUCTURE AND VARIABLE APERTURE PORE FUNCTION OF HEXAGONAL SUBUNITS IN PLASMA MEMBRANES R. D. Schultz, S. K. Asunmaa, and F. D. Kleist (McDonnell-Douglas Astron. Co., Newport Beach, Calif.) 36 p refs (See N69-35138 20-04)

4. CHARACTERIZATION OF ORDERED WATER IN HYDROPHILIC MEMBRANE PORES R. D. Schultz, S. K. Asunmaa G. A. Guter, and F. E. Littman (McDonnell-Douglas Astron. Co., Newport Beach, Calif.) 26 p refs (See N69-35139 20-04)

5. HIGH RESOLUTION ELECTRON MICROSCOPY APPLIED TO THE STUDY OF NERVE MEMBRANES H. Fernandez-Moran 10 p refs (See N69-35140 20-04)

6. ELECTRON MICROSCOPY OF A HEMAGGLUTININ FROM LIMULUS POLYPHEMUS H. Fernandez-Moran, J. J. Marchalonis, and G. M. Edelman 6 p refs (See N69-35141 20-04)

7. THE ELECTRON MICROSCOPE. PART 1: TOWARD THE CENTER OF LIFE H. Fernandez-Moran 3 p (See N69-35142 20-04)

8. ELECTRON MICROSCOPE. PART 2: BIG FUTURE FOR DEMAGNIFICATION H. Fernandez-Moran 2 p (See N69-35143 20-04)

9. HUMANITY AND SCIENCE AT THE CROSSROADS H. Fernandez-Moran 8 p (See N69-35144 20-04)

10. THE WORLD OF INNER SPACE H. Fernandez-Moran 12 p (See N69-35145 20-04)

N69-35136*# Chicago Univ., Ill.
RESEARCH AND TRAINING PROGRAM IN SPACE-MOLECULAR BIOLOGY CONDUCTED AT FACILITIES FOR HIGH RESOLUTION ELECTRON MICROSCOPY
In its Invest. in Space-Related Mol. Biol. Including Considerations of the Mol. Organ. in Luster Sounding Rocket Program 31 Aug. 1969 95 p refs (See N69-35135 20-04)
Avail: CFSTI CSCL 06C

Significant developments in a research and training program in space-molecular biology, carried out with high resolution electron microscopy, are reported. Specific topics include continued investigation of (1) particles obtained from the Luster Sounding Rocket Experiment and techniques for nondestructive analysis of extraterrestrial matter; (2) high-resolution electron-optical information storage and retrieval, including methods for ultraminiaturization and information storage and retrieval at the molecular and near-atomic level and instrumentation for a portable retrieval system adaptable to lunar and planetary missions; (3) cryo- and high voltage electron microscopy with superconducting lenses and closed-cycle liquid helium refrigerator; (4) electron microscopy of DNA conformations associated with chloroplast membranes; (5) RNA polymerase to determine its role in the differential RNA transcription upon DNA templates; and (6) organized water as an integral structural component of biological systems. Author

N69-35137*# Chicago Univ., Ill.
ELECTRON MICROSCOPY OF DNA CONFORMATIONS IN SPINACH CHLOROPLASTS
C. L. F. Woodcock and H. Fernandez-Moran *In its* Invest. in Space-Related Mol. Biol. Including Considerations of the Mol. Organ. in Luster Sounding Rocket Program 31 Aug. 1969 9 p refs Repr. from J. Mol. Biol., no. 31, 1968 p 627-631 (See N69-35135 20-04)
Avail: CFSTI CSCL 06C

The successful application of techniques for the isolation and purification of spinach leaf chloroplasts on a microscale is reported. This has enabled visualization by electron microscopy of the DNA associated with each chloroplast, following disruption by osmotic shock. DNA molecules extracted from purified chloroplasts were also analyzed. Examination of these preparations under controlled experimental conditions consistently revealed two major DNA conformations and a characteristic association with the chloroplast membrane system. Author

N69-35138*# McDonnell-Douglas Astronautics Co., Newport Beach, Calif. Western Div.
ULTRASTRUCTURE AND VARIABLE APERTURE PORE FUNCTION OF HEXAGONAL SUBUNITS IN PLASMA MEMBRANES
R. D. Schultz, S. K. Asunmaa, and F. D. Kleist *In* Chicago Univ. Invest. in Space-Related Mol. Biol. Including Considerations of the Mol. Organ. in Luster Sounding Rocket Program 31 Aug. 1969 36 p refs Presented at the 2nd Intern. Meeting Intern. Soc. for Neurochem., Milan, 1-5 Sep. 1969 (See N69-35135 20-04) (Douglas Paper-10246) Avail: CFSTI CSCL 06A

High resolution electron micrographs revealed arrays of hexagonal subunits, ≈ 90-95 Å diameter, in a black lipid membrane of the type in which nerve-like electrical activity was induced by addition of the circular polypeptide antibiotic, alamethicin. The subunits appear to be related to those reported in junctional sites where adjacent membranes of living cells are known to be in electrical contact. Molecular models of the subunits strongly suggest that they act, in association with absorbed allosteric proteins, as variable aperture pores in the cellular membrane. The arrangement and movement of cholesterol molecules in these models resemble those of the leaves of a between-the-lens shutter of a modern camera. The possible roles of the hexagonal subunits in ion-gating, nerve conduction, sensory reception and active transport are discussed in some detail. Ordered water, whose properties have recently been characterized by this laboratory, is an important structural component of the hexagonal subunit. Author

N69-35139*# McDonnell-Douglas Astronautics Co., Newport Beach, Calif. Western Div.
CHARACTERIZATION OF ORDERED WATER IN HYDROPHILIC MEMBRANE PORES
R. D. Schultz, S. K. Asunmaa, G. A. Guter, and F. E. Littman *In* Chicago Univ. Invest. in Space-Related Mol. Biol. including considerations of the Mol. Organ. in Luster Sounding Rocket Program 31 Aug. 1969 26 p refs Presented at the 2nd Intern. Meeting Intern. Soc. for Neurochem., Milan, 1-5 Sep. 1969 (See N69-35135 20-04)
(Douglas Paper-10247) Avail: CFSTI CSCL 06A

Ordered water, whose presence in biological membranes is often postulated, was characterized in cellulose acetate and porous glass desalination membranes. Above a certain critical diameter, each membrane pore was lined with a ~22 Å thick hydration sheath of highly hydrogen-bonded water in which salt is essentially insoluble. A pore with an ideal critical diameter of ~44 Å was almost entirely filled with ordered water whose average viscosity is 0.36 poise, almost 39 times greater than that of ordinary water at 23°C. The simple assumption of approximate equality between hydration sheath thickness and the average diameter of a flickering cluster permitted a rate process calculation of the permeation of salt-free ordered water through an ideal desalination membrane in good agreement with experimental data. The aqueous cylinders in the liquid-crystalline hexagonal phase of a brain phospholipid-water system are mainly ordered-water stabilized by the polar ends of the phospholipid molecules. The insolubility of salt in the ordered water indicates a high electrical resistivity. Author

N69-35140*# Chicago Univ., Ill.
HIGH RESOLUTION ELECTRON MICROSCOPY APPLIED TO THE STUDY OF NERVE MEMBRANES
H. Fernandez-Moran *In its* Invest. in Space-Related Mol. Biol. including considerations of the Mol. Organ. in Luster Sounding Rocket Program 31 Aug. 1969 10 p refs (See N69-35135 20-04)
Avail: CFSTI CSCL 06A

A research program is described which includes studies into the following related problems of nerve membrane ultrastructure that are particularly suitable for correlated electron microscopic investigations: (1) elucidation of multienzyme and other macromolecular components closely associated with cell membranes, for carrying out energy and information transduction functions; and (2) study of the association of nucleic acids and the protein synthetic machinery with cell membranes to gain a better understanding of membrane biosynthesis, including study of DNA and RNA conformations associated with membranes in chloroplasts, mitochondria, and in nerve cells, and study of RNA polymerase and its participation in the differential RNA transcription upon DNA templates. Author

N69-35141*# Chicago Univ., Ill.
ELECTRON MICROSCOPY OF A HEMAGGLUTININ FROM LIMULUS POLYPHEMUS

H. Fernandez Moran, J. J. Marchalonis, and G. M. Edelman *In its* Invest. in Space-Related Mol. Biol. Including Considerations of the Mol. Organ. in Luster Sounding Rocket Program 31 Aug. 1969 6 p refs Repr. from J. Mol. Biol., no. 32, 1968 p 467–469 (See N69-35135 20-04)
Avail: CFSTI CSCL 06A

Electron microscopic evidence that the ring structures previously observed correspond to Limulus hemagglutinin, and additional details of its structure are presented. These studies were designed to provide optimum conditions for consistent attainment of high resolution. The microscopes were provided with a highly regulated power supply (50 kw motor generator set, equipped with a new solid-state regulator giving better than 0.1% voltage stability and very low harmonic distortion). A Siemens Elmiskop 1 and Elmiskop 1A, and a Hitachi 11B microscope were used, operating mainly at 75, 80 and 100 kv. All microscopes were provided with improved pointed filaments of single-crystal tungsten with a tip radius of 1 to 10 μ, in special guns of the thin-film molybdenum cap type. Author

N69-35142*# Chicago Univ., Ill.
THE ELECTRON MICROSCOPE. PART 1: TOWARD THE CENTER OF LIFE
Humberto Fernandez-Moran *In its* Invest. in Space-Related Mol. Biol. Including Considerations of the Mol. Organ. in Luster Sounding Rocket Program 31 Aug. 1969 3 p (See N69-35135 20-04)
Avail: CFSTI CSCL 06C

Advances in instrumentation and techniques in electron microscopy, as applicable to the study of biological ultrastructure, are reported. Of particular importance in the new methodology is the use of a diamond knife that is operated in an evacuated microtome at cryogenic temperatures to minimize rearrangement of the molecules in biological specimens. The results have been the viewing of deoxyribonucleic acid (DNA) molecules, including the transfer of information from DNA to the building centers of cells by ribonucleic acid (RNA). The primary goal of viewing the DNA molecular structure directly is also mentioned, which requires specimens in the domain of 1 to 2A. A.C.R.

N69-35143*# Chicago Univ., Ill.
ELECTRON MICROSCOPE. PART 2: BIG FUTURE FOR DEMAGNIFICATION
Humberto Fernandez-Moran *In its* Invest. in Space-Related Mol. Biol. Including Considrations of the Mol. Organ. In Luster Sounding Rocket Program 31 Aug. 1969 2 p (See N69-35135 20-04)
Avail: CFSTI CSCL 06C

The application of electron microscopy to studies of human perception and the development of prosthetic sensors is briefly treated. By demagnification, information can be stored and retrieved, where the size of letters of a page are only about 100 atoms high. Further research could lead to the use of electron microscopic potential in miniaturized computers. Additionally, this instrumentation can enable duplication of the memory portion of the brain when used along with holographic techniques. As a final application, the electron microscope shows potential for gaining information on the atomic structure and organization of space. A.C.R.

N69-35144*# Chicago Univ., Ill.
HUMANITY AND SCIENCE AT THE CROSSROADS
Humberto Fernandez-Moran *In its* Invest. in Space-Related Mol. Biol. Including Considerations of the Mol. Organ. in Luster Sounding Rocket Program 31 Aug. 1969 8 p (See N69-35135 20-04)
Avail: CFSTI CSCL 06J

The spirit of individual innovation and the cooperative endeavors of human minds are emphasized as the key factors in guiding science and technology to higher levels of achievement. The need for social and geopolitical cooperation between North and South American nations is also cited; the United States primarily requires natural resources and markets, while Latin America needs technical, scientific, and managerial assistance. A brief approach to such cooperative endeavors is outlined, as well as several of the great problems of Latin America. A.C.R.

N69-35145*# Chicago Univ., Ill.
THE WORLD OF INNER SPACE
Humberto Fernandez-Moran *In its* Invest. in Space-Related Mol. Biol. including considerations of the Mol. Organ. in Luster Sounding Rocket Program 31 Aug. 1969 12 p (See N69-35135 20-04)
Avail: CFSTI CSCL 04B

The potential uses of electron microscopy, as well as the basic principles of the technique, are treated. Improvements required for successful application of the instrument to studies of molecular and atomic structure are identified in three major areas: (1) operational environment; (2) instrumentation, and (3) preparation methods. Another primary goal of achieving a coherent electron beam, which would improve basic resolution and enable high resolution holography through utilizing superconducting lenses, is also treated. Finally, demagnifying techniques and use of the diamond knife to allow quantitative predictions concerning the behavior of biological matter are covered. Specific emphasis is placed on potential studies into the nature of deoxyribonucleic (DNA). A.C.R.

N69-35185# Defense Documentation Center, Alexandria, Va.
RESPIRATORY EFFECTS OF SPACE TRAVEL, VOLUME 1
May 1969 107 p refs
(AD-686900; DDC-TAS-69-29-1) Avail: CFSTI CSCL 6/16

This bibliography is a collection of 72 unclassified and unlimited references on respiration during space travel received by DDC from March, 1953 to December, 1968. The bibliography contains references and abstracts on such subjects as anoxia, hypoxia, weightlessness, variable concentration atmospheres, physiological effects and tolerances -- all with respect to respiration in space. Indexes by Corporate Author/Monitoring Agency, Subject, and Personal Author are given. Volume 2(AD-852 001) of this bibliography, which is a limited version, combines the limited references with all of the references in this unlimited volume, Volume I. Author (TAB)

N69-35258# Defence Research Board, Ottawa (Ontario). Defence Scientific Information Service.
INFLUENCE OF TEMPERATURE ON CARRIER PIGEON HOMING ABILITY AND DEMONSTRATION OF AN UNKNOWN EFFECT
Gustav Kramer et al Apr. 1969 32 p refs Transl. into ENGLISH from German Periodical
(T-120-G) Avail: CFSTI

CONTENTS:

1. INFLUENCE OF TEMPERATURE AND EXPERIENCE ON HOMING ABILITY OF CARRIER PIGEONS G. Kramer p 1–5 (See N69-35259 20-04)

2. FURTHER EXPERIMENTS ON "WINTER EFFECT" IN CARRIER PIGEONS' HOMING ABILITY G. Kramer et al p 6–22 refs (See N69-35260 20-04)

3. SHORT-DISTANCE HOMING OF CAGE-PIGEONS G. Kramer et al p 23–27 refs (See N69-35261 20-04)

N69-35280# Defence Research Board, Ottawa (Ontario). Defence Scientific Information Service.

INFLUENCE OF TEMPERATURE AND EXPERIENCE ON HOMING ABILITY OF CARRIER PIGEONS

Gustav Kramer *In its* Influence of Temp. on Carrier Pigeon Homing Ability and Demonstration of an Unknown Effect Apr. 1969 p 1–5 Transl. into ENGLISH from J. Ornithol., no. 95, 1954 p 343–347 (See N69-35258 20-04)
Avail: CFSTI

The homing ability of pigeons in different seasons of the year for three flight courses is reported, as well as the criteria for the homing instinct. The reduced homing capability in winter is discussed along with the straying bird problem. Experimental homing results are listed in tabular form. J.A.M.

N69-35280# Defence Research Board, Ottawa (Ontario). Defense Scientific Information Service.

FURTHER EXPERIMENTS ON "WINTER EFFECT" IN CARRIER PIGEONS' HOMING ABILITY

Gustav Kramer et al *In its* Influence of Temp. on Carrier Pigeon Homing Ability and Demonstration of an Unknown Effect Apr. 1969 p 6–22 refs Transl. into ENGLISH from J. Ornithol., no. 97, 1956 p 353–370 (See N69-35258 20-04)
Avail: CFSTI

The homing ability of inexperienced carrier piegeons during the winter is discussed. The experimental results are presented in terms of the number of birds going astray and the homing times. The main flight course used was from Hohenkirchen to Wilhelmshaven (22 km). The mechanism of orientation and the reason for reduced homing instinct in winter are presented as unknown. J.A.M.

N69-35281# Defence Research Board, Ottawa (Ontario). Defence Scientific Information Service.

SHORT-DISTANCE HOMING OF CAGE-PIGEONS

Gustav Kramer et al *In its* Influence of Temp. on Carrier Pigeon Homing Ability and Demonstration of an Unknown Effect Apr. 1969 p 23–27 refs Transl. into ENGLISH from J. Ornithol., No. 97, 1956 p 371–376 (See N69-35258 20-04)
Avail: CFSTI

Experimental results of releasing caged birds for the first time and evaluating the homing capability are presented. The homing method is discussed as being unknown. A comparison is drawn between the homing ability of caged birds and control pigeons. J.A.M.

N69-35333# Atomic Energy Commission Research Establishment, Riso (Denmark).

MICROBIOLOGICAL CONTROL OF RADIATION STERILIZATION OF MEDICAL SUPPLIES. PART 1: TOTAL COUNT ON MEDICAL PRODUCTS (DISPOSABLE SYRINGES AND DONOR SETS) PRIOR TO RADIATION STERILIZATION

Ebbe Ahrensburg Christensen, S. Mukherji, and Niels W. Holm Aug. 1968 24 p refs
(Contract IAEA-473/RB)
(RISO-122) Avail: CFSTI

A technique for the determination of the number of microorganisms on dry disposable equipment, e.g. hypodermic syringes and donor sets from different producers, is described. The equipment was flushed, the flushing liquid filtered and the filter placed on agar. The method of counting and subsequent sterilization by irradiation is described. Author (ESRO)

N69-35355# Environmental Data Service, Silver Spring, Md.

SOME INVESTIGATION RESULTS AT VNIGL (VALDAY HYDROLOGIC SCIENTIFIC RESEARCH LABORATORY OF THE STATE HYDROLOGICAL INSTITUTE) PROVING GROUNDS FOR PRECIPITATION GAGES [NEKOTORE REZULTATY ISSLEDOVANII NA OSADKOMERNOM POLIGONE VNIGL]

V. S. Golubev Mar. 1969 27 p refs Transl. into ENGLISH from Tr. Gos. Gidrologicheskii Inst. (USSR), no. 123, 1965 p 81–95
(PB-183143T; WB-T-113) Avail: CFSTI CSCL 14B

The problem of computing atmospheric precipitation correctly with various precipitation gages has been repeatedly examined in recent literature and at special conferences where it was noted that both the solid and liquid precipitation were as a rule under calculated. The deficiency value depends on the type of instrument, its location site, the characteristics of precipitation, and type as well as upon meteorological conditions (wind speed, temperature, humidity, etc.). The program of investigations was divided into the following groups: (1) investigation of the wind field of the area of operation; (2) investigation of uniformity of precipitation upon the area of operation; (3) investigation of deficiency in precipitation recordings by precipitation gages caused by the effect of wind, wetting and evaporation. Author (USGRDR)

N69-35414*# Midwest Research Inst., Kansas City, Mo.

APPLICATION OF AEROSPACE-GENERATED TECHNOLOGY TO WATER POLLUTION AND OTHER PUBLIC SECTOR PROBLEMS Quarterly Report 1 Dec. 1968-28 Feb. 1969

David Bendersky, Andrew J. Winfrey, and Edward T. Fago 14 Mar. 1969 23 p
(Contract NSR-26-002-083; MRI Proj. 3217-E(B-C))
(NASA-CR-104198; QR-3) Avail: CFSTI CSCL 06I

This study aims to apply aerospace-generated technology to a minimum of 12 specific water pollution problems that have a high potential for being solved by such techniques. In this report, 22 problems are specified. An initial screening indicated that the following four problems represent good possibilities for application: (1) methods, techniques, and equipment for aerial surveillance of water quality; (2) sensor system for detecting radiological emissions in streams or impoundments at remote locations; (3) a simplified, inexpensive method for detecting radium 226 in bodies of water; and (4) laser applications for laboratory analysis of water pollution. The remaining problems involve detection and effects of oil in water, analyses of water properties and composition, efficiency of waste treatment, and the growth of algae and other organisms in water. K.W.

N69-35449# Michigan Univ., Ann Arbor. Logic of Computers Group.

FORMALISMS FOR LIVING SYSTEMS, PART 1

Richard A. Laing Mar. 1969 99 p refs
(Contracts DA-31-124-ARO(D)-483; N00014-67-A-0181; Grant NIH GM-12236-03)
(AD-687382; Rept-08226-8-T; AROD-6499.10-M) Avail: CFSTI CSCL 6/4

Various formalisms for expressing the structure and behavior of biological systems are proposed and discussed. The formalisms include tiling or domino systems, the von Neumann cellular automaton system, and several systems based on the monogenic normal systems Tag and Lag. There is some discussion of desirable characteristics of models for biological theory. Author (TAB)

N69-35485*# New Mexico State Univ., Las Cruces. Dept. of Biology.
MICROORGANISM STUDY, DESERT FUNGI Final Technical Report
E. E. Staffeldt 10 Jul. 1969 10 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951602)
(NASA-CR-105305) Avail: CFSTI CSCL 06C

Fungal isolates were extracted from soils removed under desert conditions in Chile, Egypt, Oregon, Wyoming, Hawaii and White Mountain of California. These organisms were transferred to Czapek's and carrot decoction agars to facilitate identification. Complete fungal description charts have been submitted on the isolates including order, family, genus, species, colony characteristics, and sexual or asexual reproductive aspects. Author

N69-35527*# Techtran Corp., Glen Burnie, Md.
DIURETIC EFFECT OF WATERMELON, PART 2
T. Isawa et al Washington NASA Aug. 1969 3 p Transl. into ENGLISH from Japan. J. Med. Sci. Biol. (Tokyo), Sect. 8, v. 5, 1939 p 209–210
(Contract NASw-1695)
(NASA-TT-F-12505) Avail: CFSTI CSCL 06P

Citrulline and arginine fractions were isolated as the diuretically effective agents in watermelons, and the mechanism of these fractions was tested in animals intoxicated with chloroform, CCl_4 and phosphories. Along with the influence of the citrulline fraction, toward the encouragement of urea formation, there is a secondary effect, an ammonia stimulating influence in the blood. Thus the authors were able to apply the citrulline fraction to lower a dangerously increasing blood-ammonia level. Author

N69-35548*# Techtran Corp., Glen Burnie, Md.
RESEARCH ON THE SCATTERING OF LIGHT IN THE HUMAN EYE [RECHERCHES SUR LA DIFFUSION DE LA LUMIERE DANS L'OEIL HUMAIN]
Yves le Grand Washington NASA Aug. 1969 28 p refs Transl. into ENGLISH from Rev. Opt. (Paris), v. 16, no. 8, 1937 p 241–266
(Contract NASw-1695)
(NASA-TT-F-12344) Avail: CFSTI CSCL 06P

An experimental study was made with 3 subjects to determine light flux scattered in the human retina. The findings are explained by a 3.5% retinal flux. Scattering increases sharply during the first few minutes of adaptation to darkness. Author

N69-35588 Arbeitsgruppe Biophysikalische Raumforschung, Frankfurt am Main (West Germany).
PROBLEMS OF ESTIMATING BIOLOGICAL RADIATION DOSES AND RADIATION PROTECTION IN SPACE
H. Bücker and W. Völker *In* CERTS Determination of Radiation Doses in Space 1968 p 195–206 refs (See N69-35576 20-29)
Copyright Avail: Issuing Activity

A discussion of radiation hazards and radiation protection in manned space operations requires considerations quite different from those that would apply to occupational exposure under terrestrial conditions. The recommendations concerning radiation protection on earth avoid exact determinations of the biological radiation doses by defining the maximum permissible doses under worst conditions, and a large safety factor is involved. This approximation is not acceptable for radiation protection in manned space flight for it does not lead to optimal safety of the entire mission, for by enlarged dead-weight-shielding other risks could be increased. For this reason in manned space flight radiation hazards ought to be estimated as exactly as possible. Some space radiations which might be biologically important have unknown physical parameters and the biological efficiency of other radiations, which are being gated, is still unknown. Therefore, radiation dosimetry and radiation protection in space require exact analyses of the three components of space radiation particularly their physical parameters and their biological effects. The radiation dose in a space ship and in the body of the astronaut depends mainly on secondary radiation and bremsstrahlung produced in the absorber. Because of the most complex conditions a calculation of the dose based on the data of the incident beam is not possible and this problem is discussed. Author (ESRO)

N69-35608# National Inst. of Radiological Sciences, Chiba (Japan).
[RADIOLOGICAL SCIENCES] Annual Report
Oct. 1968 111 p refs
(NIRS-7; AR-7) Avail: AEC Depository Libraries

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5. PHYSIOLOGY p 36–54 refs
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8. ENVIRONMENTAL STUDIES p 83–96 refs

N69-35609# National Inst. of Radiological Sciences, Chiba (Japan).
PHYSICS
In its Radiol. Sci. Oct. 1968 p 1–11 refs (See N69-35608 20-04)
Avail: AEC Depository Libraries

Research in physics at the National Institute of Radiological Sciences during 1967 is reported. The research includes a new detection method of small ionization current based on oscillation of a dynamic capacitor, measurement of plutonium lung burden in vivo, high-sensitivity continuous plutonium air monitor, experimental determination of energy spectrum of megavolt x rays, neutrons from thick-target beryllium (d,n) reactions at 1.0 to 3.0 MeV, attenuation of high energy x rays, energy dependence of LiF, CaF_2, and $CaSO_4$(Mn) thermoluminescent dosimeters for high-energy electrons, estimation of gamma dose from neutron-induced radioactivity in Hiroshima and Nagasaki, and fast neutron dose distribution in tissue-equivalent phantom. Author (NSA)

N69-35611# National Inst. of Radiological Sciences, Chiba (Japan).
BIOLOGICAL STUDIES
In its Radiol. Sci. Oct. 1968 p 21–35 refs (See N69-35608 20-04)
Avail: AEC Depository Libraries

Research was conducted on the effects of irradiation on animal and human cells. Separate reports are presented in physiology, biochemistry and biophysics, genetics, cytology and morphology, medical studies, and environmental studies. The reports in physiology are concerned with whole body recovery, rate of spermatogenesis, hematopoietic cells and tissue, cell proliferation in the intestinal epithelium, DNA synthesis, nuclear RNA polymerase, and thrombocyte. The biophysical and biochemical reports are concerned with molecular degradation in cells, especially DNA, ATP, and

enzymes. Genetic studies are concerned with lethal chromosomes and mutants. Analyses of radioactive isotopic metabolism in man are presented along with methods for dosage calculation and tracer techniques. Environmental studies on whole body retention of radiation are also presented. J.M.C.

N69-35614*# National Aeronautics and Space Administration, Washington, D.C.

RESPIRATORY TESTS IN DYNAMIC HYPERTHERMIA DUE TO INGESTION OF PROTEIN [RESPIRATIONSVERSUCHE BEI DYNAMISCHER EIWEISSHYPERTHERMIE]

H. Rietschel et al Sep. 1969 12 p refs Transl. into ENGLISH from Arch. Exp. Pathol. Pharmakol. (Berlin), v. 121, 1927 p 332–341 (NASA-TT-F-12509) Avail: CFSTI CSCL 06P

Protein feeding experiments in a respiratory apparatus were conducted to determine the effects of protein ingestion on body temperature, in both adults and infants. The rise in temperature after ingestion of large quantities of proteins is considered to be a form of hyperthermia. It is concluded that the administration of protein in a liquid-restricted diet results in a more pronounced heat production than in diets with adequate liquids, and since the body can dissipate only small quantities of heat, hyperthermia develops. Tables of basal metabolism rate, and temperature during restriction of liquids with protein feeding are included. F.O.S.

N69-35634*# National Aeronautics and Space Administration, Washington, D.C.

ON THE QUESTION OF BLASTOPORE CLOSURE IN RANA FUSCA

M. Moszkowski Aug. Transl. into ENGLISH from Arch. Mikroskopsiche Anatomie, v. 60, 1902 p 407–413 (NASA-TT-F-12508) Avail: CFSTI CSCL 06C

Mechanisms of egg yolk-sac rupture and blastopore formation are described. Observations show that the ruptures are connected with the resistance power of the outer layers of the egg and represent the first step in the development of extraovates. E.C.

N69-35635*# National Aeronautics and Space Administration, Washington, D.C.

TWO CASES OF POTOMANIA [DEUX OBSERVATIONS DE POTOMANES]

M. Labbe et al Aug. 1969 13 p refs Transl. into ENGLISH from Bull. Soc. Med. Hop., Paris, v. 55, 1931 p 1072–1078 (NASA-TT-F-12500) Avail: CFSTI CSCL 06P

Case histories of two female individuals suffering from alimentary disorders of psychogenic origin are considered. Arguing from the point of view of complex mental processes and demonstrable behavioral aberration, the purpose of this report is to discredit the easy diagnosis of diabetus insipidus or azotic diabetus and too ready treatment of similar cases by pharmaceutical means. Symptoms of potomania, polyuria, and phagomania, and the routine of deception in the habits of these patients to satisfy their urgings are reported. Hospital treatment by isolation, strict supervision of water and solid intake, and general metabolic surveillance succeeded in persuading the patients temporarily in the effective control of their conditions. General discussion of the cases emphasizes the difficulties of differential diagnosis and treatment of the obsession underlying both potomania and phagomania. M.H.E.

N69-35637*# National Aeronautics and Space Administration, Washington, D.C.

THIRST AFTER BLEEDING [LA SOIF APRES LA SAIGNEE]

Brocq-Rousseau et al Sep. 1969 10 p refs Transl. into ENGLISH from Sang (Paris), v. 3, 1929 p 44–50 (NASA-TT-F-12511) Avail: CFSTI CSCL 06P

Experiments with thirst in horses after drawing blood, at the rate of 6000 ml weekly, were conducted for a year. Water intake was measured on days of bleeding and days of nonbleeding. Averages of water intake by individual animal are tabulated. It is concluded that animals drink more than normal after bleeding. F.O.S.

N69-35639# Joint Publications Research Service, Washington, D.C.

RADIOBIOLOGY, VOLUME 8, NO. 2 [RADIOBIOLOGIYA, TOM 8, VYPUSK 2]

Oak Ridge, Tenn. AEC 1968 272 p refs Transl. into ENGLISH from Radiobiologiya (Moscow), v. 8, no. 2, 1968 p 179–328 Sponsored by AEC (AEC-TR-6915-Vol-8-no-2) Avail: CFSTI

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34. BIOLOGICAL EFFECTS OF IRRADIATION OF VARIOUS INTENSITIES I. G. Akoev et al p 253–256 (See N69-35641 20-04)

N69-35639# Joint Publications Research Service, Washington, D.C.

INFLUENCE OF HOT PARTICLES ON HUMAN CELLS

S. I. Tarasov et al *In its* Radiobiol., vol. 8, no. 2 1968 p 53–61 refs (See N69-35638 20-04)
Avail: CFSTI

A culture of embryonic cells (fibroblasts) was used to study the biological hazards of particles with high absolute radioactivity, of the order of 10^{-11}–10^{-8} Ci, and the penetration and prolonged fixation of these hot particles into human lungs. The model was created by irradiating a specially prepared metallic powder of stable cobalt with a flux of neutrons. The absolute activity of each of the cobalt 60 particles obtained was 10^{-9} Ci. One of the most complex problems in formulating the experiment proved to be a search for a method for fixation of the microscopic cobalt particles in the growth zone of the cells. A laser apparatus was ultimately successful. The biological effects established were an inhibition of mitosis and an increase in the frequency of chromosome rearrangements. Further experiments were recommended to study the duration of delay of mitosis and the death of cells, as well as the correlation between biological effects and absorbed doses. A.C.R.

N69-35641# Joint Publications Research Service, Washington, D.C.

BIOLOGICAL EFFECTS OF IRRADIATION OF VARIOUS INTENSITIES

I. G. Akoev et al *In its* Radiobiol., vol. 8, no. 2 1968 p 253–256 (See N69-35638 20-04)
Avail: CFSTI

The clinical course of radiation sickness in dogs subjected to gamma irradiation at various intensities was studied. Dose rates from 0.1 to 894 R/min were used, or the dose was split into two to ten fractions. Special attention was paid to clinical expression of general primary response manifestations and the height period of the disease. The expression of primary responses varied more substantially than the general severity of radiation sickness, and the results of observations for fractionated irradiation proved particularly unexpected. The degree of expression of primary responses under these conditions increased with each fraction of irradiation only up to a definite dose level. Further irradiation resulted in weakening or disappearance of primary response manifestations. A.C.R.

N69-35685*# National Aeronautics and Space Administration, Washington, D.C.

DIPSOMANIA AND POTOMANIA [DIPSOMANIE ET POTOMANIE]

R. Boulin et al Aug. 1969 7 p Transl. into ENGLISH from Prat. Med. Franc. (Paris), no. 11, 1930 p 211–214
(NASA-TT-F-12504) Avail: CFSTI CSCL 06P

The psychophysiological changes in the desire to drink which are reflected in clinical syndromes known as potomania and dipsomania are investigated. The main sympton of potomania is shown to be the continuous desire to drink abnormal quantities of liquid regardless of the nature of the liquid ingested. Dipsomania is distinguished from the former by its periodic and paroxysmal character. However, the distinguishing features between drunkenness

and dipsomania are not always distinct since an acquired form exists resulting from habitual abnormal ingestion. Dipsomania is characterized by the appearance of periodic episodes of polydipsia, between which the desire to drink is normal. The successive development of episodes of dipsomania were found for definite hysteria. It is concluded that without a careful search for pituitary symptoms and signs characteristic of diabetes insipidus, these forms of polyuria may be confused with various types of other polyuria due to changes in the water metabolism. F.O.S.

N69-35705*# Techtran Corp., Glen Burnie, Md.
NON-DESTRUCTIVE DOSAGE OF THE MINERAL COMPOSITION OF BONE TISSUE BY RADIOGRAPH DENSITOMETRY [DOSAGE NON DESTRUCTIF DE LA COMPOSANTE MINERALE DU TISSU OSSEAUX PAR DENSITOMETRIE RADIOGRAPHIQUE]
W. Mouvet Washington NASA Jul. 1969 134 p refs Transl. into ENGLISH from French Dissertation
(Contract NASw-1695)
(NASA-TT-F-12156) Avail: CFSTI CSCL 06R

General definitions and theoretical principles are presented. Formulas are represented for the determination of the attenuation of a bundle of X-rays in passing through a given mass of bone tissue. The various methods of absorption of X-rays passing through a body are described. Formulas for the change in wave length upon absorption are presented. Thompson and Compton diffusion, as well as photoelectric absorption, are included. The law of absorption is described as it applys to polychromatic X-rays. Densitometers of various types are described. Author

N69-35738# Army Aeromedical Research Unit, Fort Rucker, Ala.
CONTINUOUS EKG RECORDING OF HELICOPTER INSTRUCTOR PILOTS: AN INTERIM EVALUATION
William P. Shane Apr. 1969 18 p refs
(AD-688857; USAARL-69-5) Avail: CFSTI CSCL 6/16

Fifty-three (53) instructor pilots were studied with one lead of EKG for a full work day. Using Tukeys multiple comparison of means, significant differences were found between heart rates during flying and heart rates noted while driving, and while performing administrative duties. Means of lowest heart rate recorded and highest heart rate recorded for each subject were reported (means of 71.8 and 140.4 respectively). The activities in which the subjects were engaged at the time is reported. (71.7%) of the subjects engaged in no regular schedules of physical training or sports participation. An 11 x 11 correlation matrix indicates only that subjects who have high heart rates during one activity will have comparably high heart rates during all activities, and vice verse. Four of the 53 subjects showed arrythmias at some time during the recording; one had 38 unifocal ventricular premature contractions during the recording period; three had atrial premature contractions. Author (TAB)

N69-35743*# Techtran Corp., Glen Burnie, Md.
LIMITATION OF GROWTH OF BACTERIA IN LIQUIDS [ERGEBNISSE EXPERIMENTELLER POPULATIONSFORSCHUNG]
Oskar Bail Washington NASA Sep. 1969 18 p Transl. into ENGLISH from Z. Immunitaetsforsch. (Stuttgart), v. 60, no. 1/2, 1929 p 1–22
(Contract NASw-1695)
(NASA-TT-F-12480) Avail: CFSTI CSCL 06C

After a general definition of a population and population space, the factors which limit the ultimate density of a bacterial population are discussed. Malthus' theory of population growth is shown to be invalid for mature populations, in which internal and often unidentified factors limit the rate of population increase. Author

N69-35765*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
CONTRIBUTIONS TO THE PHYSIOLOGY AND PATHOLOGY OF HUMAN URIC ACID METABOLISM. REPORT 1: ON FLUCTUATIONS OF THE ENDOGENIC URIC ACID METABOLISM OF NORMAL PERSONS AND ITS REGULATION [BEITRAEGE ZUR PHYSIOLOGIE UND PATHOLOGIE DES MENSCHLICHEN HARNSAEURESTOFFWECHELS. 1 MITTEILUNG: UEBER SCHWANKUNGEN DES ENDOGEN HARNSAEURES TOFFWECHSELS DES NORMALEN UND DEREN REGULATION]
Hans Lucke Washington NASA Aug. 1969 11 p refs Transl. into ENGLISH from Ges. Exptl. Med. (Heidelberg), v. 58, 1927 p 251–261
(Contract NASw-1692)
Avail: CFSTI CSCL 06P

Investigations are performed with the aim of obtaining judgements on nuclein metabolism. Values for uric acid levels are taken from blood and urine in order to determine causes and effects of uric acid fluctuations in the normal individual and to show inferences on the mechanism involved in its functioning. Author

N69-35786*# Research Triangle Inst., Durham, N.C. Engineering and Environmental Sciences Div.
BIOMEDICAL APPLICATIONS OF NASA SCIENCE AND TECHNOLOGY Final Report, 15 Jun. 1968–14 Jun. 1969
14 Jun. 1969 74 p refs
(Contract NSR-34-004-056)
(NASA-CR-105423; RTI-EU-411-1) Avail: CFSTI CSCL 06E

During the year, 53 problems were accepted for investigation, 17 technology transfers were accomplished, 24 computerized information searches were performed, and 1 biomedical problem abstract was submitted for dissemination. The types of technology transfers ranged from purely information transfers to devices, instrumentation, and implantable prostheses. NASA-developed fluid control technology wad adapted to the design and fabrication of a prototype prosthetic urethral valve. Information on ultrasonic nondestructive testing was transferred to a research program in diagnostic ultrasonics. Ferrite pressure transducers developed for measuring pressures in materials used by NASA are being adapted to the measurement of blood flow in the human body. An additional transfer of interest was the application of low-velocity flight balance instrumentation developed in the Soviet space program to monitoring of the flight of birds. Author

N69-35893*# Naval Aerospace Medical Inst., Pensacola, Ala.
ASSESSMENT OF SEMICIRCULAR CANAL FUNCTION. PART 2: INDIVIDUAL DIFFERENCES IN SUBJECTIVE ANGULAR DISPLACEMENT PRODUCED BY TRIANGULAR WAVEFORMS OF ANGULAR VELOCITY
Gale G. Owens and Fred E. Guedry, Jr. 17 Jun. 1969 21 p refs Prepared jointly by Navy and Army
(NASA Order R-93)
(NASA-CR-105431; NAMI-1074; USAARL-69-13) Avail: CFSTI CSCL 06P

Development of methods and procedures to provide psychophysical measures of semicircular canal function which have high test–retest reliability and which are practical from the point of view of short arcs of passive whole-body rotation about an earth-vertical axis were accurate when subjects used a psychophysical procedure which involved counterdisplacement of a pointer on a dial. The required retrospective displacement judgments yielded more accurate mean estimates of angular displacement than were obtained in an earlier experiment which probably involved concurrent velocity matching. The differences in response curves in the various

conditions of the two experiments clearly illustrate the importance of attention of psychophysical procedures prior to attempting to develop models of the vestibular endorgans to explain differences within a sample of aviation candidates, and the results obtained thus far indicate a high test – retest reliability. Author

N69-35903*# Mississippi State Univ., State College. Dept. of Microbiology.
INFLUENCE OF METABOLIC ACCUMULATION OF PRODUCTS OF HYDROGENOMONAS CELLS ON THEIR CONTINUED GROWTH, 1 JULY 1964 – 30 JUNE 1969
Robert G. Tischer Jun. 1969 139 p refs
(Grant NGR-28-001-004)
(NASA-CR-105393) Avail: CFSTI CSCL 06C

Evaluated are bioregenerative systems of *Hydrogenomonas eutropha* and *Hydrogenomonas thermophilus* cells for their utilization of hydrogen in a closed ecological manned space flight environment that uses water electrolysis for producing oxygen. Analyses of the efficiencies of the proposed test organisms, the effects of metabolic wastes on their growths, and the comparative values of *Hydrogenomonas* and other hydrogen utilizing organisms indicate that neither algal ecologies nor electrolytic-hydrogenomonas systems are acceptable for use in their present state. G.G.

N69-35909*# National Aeronautics and Space Administration, Washington, D.C.
MEDICAL AND BIOLOGICAL TESTS ABOARD THE VOSKHOD SPACESHIP [MEDIKO-BIOLOGICHESKIYE ISSLEDOVANIYA NA KOSMICHESKIKH KORABLYAKH TIPA VOSKHOD]
O. G. Gazenko et al Aug. 1969 19 p Transl. into ENGLISH from Vestn. Akad. Nauk SSSR (Moscow), v. 35, Aug. 1965 p 19–26
(NASA-TT-F-12517) Avail: CFSTI CSCL 06S

Preliminary results of some physiological tests conducted during the flights of the Voskhod 1 spaceship and during the Voskhod 2 are discussed. Electrocardiograms, seismocardiograms, pneumograms, electroencephalograms, electrooculograms, blood tests, pulmonary ventilation, vestibular tests, and the hygienic parameters of the spacesuit medium are discussed. No indications of disorders in the basic functional systems of the men were observed and it is concluded that during the flight the cosmonauts maintained adequate physical and operational efficiency. Author

N69-35923*# Sandia Corp., Albuquerque, N. Mex. Planetary Quarantine Dept.
A MODEL FOR THE QUANTIFICATION OF THE QUALITATIVE MICROBIAL SAMPLING PROBLEM
A. L. Roark May 1969 16 p refs
(NASA Order W-12-853)
(NASA-CR-105394; SC-RR-69-310) Avail: CFSTI CSCL 06C

In information systems design for lunar programs, a mathematical model is described called the Probability-of-Identifying-All Model. Its purpose is to estimate the probability that all microorganism species on an Apollo module were identified by the environmental and surface sampling. Here a simple model for this purpose is proposed. It will also provide information which will be useful in establishing sampling protocall. Author

N69-35962# Army Medical Research Lab., Fort Knox, Ky. Experimental Psychology Div.
EFFECTS OF THE INTENSITY OF AUDITORY AND VISUAL READY-SIGNALS ON SIMPLE REACTION TIME
David L. Kohfield 13 Mar. 1969 15 p refs
(AD-688874; USAMRL-817) Avail: CFSTI CSCL 5/10

The effects of auditory and visual ready-signal intensity were investigated in a simple reaction time (RT) task. Mean RT to three auditory response-signals was found to systematically increase with a corresponding increase in the intensity of either auditory or visual ready-signals. The results were analyzed according to a decision model of stimulus intensity effects. It was concluded that ready-signal intensity influenced the value of the detection criterion. Practice effects and individual differences were also significant determinants of the criterion level. Author (TAB)

N69-35968# Army Medical Research Lab., Fort Knox, Ky.
SKIN LESION THRESHOLD VALUES FOR LASER RADIATION AS COMPARED WITH SAFETY STANDARDS Final Report
Wordie H. Paar 24 Feb. 1969 15 p refs
(AD-688871; USAMRL-813) Avail: CFSTI CSCL 6/5

The large amount of skin surface makes this body tissue readily available to accidental and repeated exposures of laser radiation, and most laser safety programs include minimal radiation levels for skin exposure. However, the values suggested are generally those considered non-hazardous under worst case conditions and are not based on experimental evidence. This report briefly summarizes the few studies found in the open literature that might be considered pertinent towards establishing acceptable acute laser radiation levels for skin. The threshold lesion values given for both human and animal skin are discussed and compared with guideline values suggested for safe exposure levels. Author (TAB)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N69-34647# Wissenschaftliche Gesellschaft für Luft- und Raumfahrt, Brunswick (West Germany).
PROCEEDINGS OF THE FIFTH WGLR MEETING ON HUMAN FACTORS ENGINEERING [BERICHT UEBER DIE 5. SITZUNG DES WGLR-FACHAUSSCHUSSES FUER ANTHROPOTECHNIK]
Feb. 1968 43 p refs In GERMAN Conf. held at Berlin, 9 Jan. 1967
(DLR-MITT-68-04) Avail: CFSTI

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1. ELECTRONIC DISPLAY TECHNOLOGY AND ITS SIGNIFICANCE IN AIRCRAFT INSTRUMENTATION R. Beyer (Deutsche Forschungsanstalt fur Luft- und Raumfahrt, Brunswick) p 7–36 refs (See N69-34648 20-09)

2. PSYCHOPHYSIOLOGICAL INFLUENCES AND THEIR CONSIDERATION IN MEASUREMENTS IN MAN-MACHINE SYSTEMS H. Schmidtke (Tech. Hochschule Munchen, W. Ger.) p 37–45 (See N69-34649 20-05)

N69-34648# Technische Hochschule München (West Germany). Institut fuer Ergonomie.

PSYCHOPHYSIOLOGICAL INFLUENCES AND THEIR CONSIDERATION IN MEASUREMENTS IN MAN-MACHINE SYSTEMS [PSYCHOPHYSIOLOGISCHE EINFLUSSGROESSEN UND DEREN BERUECKSICHTIGUNG BEIDER MESSUNG IN MENSCH-MASCHINE-SYSTEMEN]

H. Schmidtke *In* WGLR Proc. of the 5th WGLR Meeting on Human Factors Eng. Feb. 1968 p 37-45 In GERMAN (See N69-34647 20-05)

Avail: CFSTI

The influence of several physiological and psychological factors on human performance in man-machine systems is discussed; in particular, motivation, sensory deprivation or overloading, vigilance, environmental conditions, as temperature, noise vibration, circadian rhythms, sleep deprivation and fatigue, well being, and visual acuity. The effects of each of these factors are described, and means for objectively determining the effects of these influences are discussed. ESRO

N69-34711*# Illinois Univ., Urbana.

REGULATION OF THERMAL SWEATING IN EVA SPACE SUITS

John C. Chato and Bruce A. Hertig 14 Jul. 1969 19 p refs (Grant NGR-14-005-103)

(NASA-CR-104071) Avail: CFSTI CSCL 06K

Metabolic heat removal in extravehicular thermoregulation space suits was studied, with emphasis on the regulation of sweat rates and the disposition of secreted sweat. Tests were conducted with volunteer subjects, and it was found that uniform direct contact cooling of the skin failed to reduce sweat secretion to a minimal level of about 100 g/hr in case of some subjects. This suggests the necessity for including a sweat removal mechanism in all space suits unless (1) physiological tests determined that the astronaut's sweat rate does not require it, or (2) another method of metabolic heat removal can be found. Two such methods are discussed. The first involves suppression of the sweat rate by zone cooling, and the second, an opposite concept, made use of the astronaut's own thermoregulatory system. The second method employs cooling by sweat evaporation and uses porous sublimator plates for the removal of moisture. K.W.

N69-34761# Army Board for Aviation Accident Research, Fort Rucker, Ala.

SAFETY IMPLICATIONS OF AIRCREW ARMOR AND ALLIED PERSONAL EQUIPMENT

Kelly G. Gregory *In* AGARD Pattern Recognition. Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 5 p (See N69-34751 20-04)

Avail: CFSTI

Various items of aircrew armor are described. Safety implications and missdventures that have occurred in their use are noted. Suggestions are given for prevention of such occurrences. Author

N69-34762# Air Force Systems Command, Brooks AFB, Tex. Aerospace Medical Div.

A NEW AIRCREW ARMOR VEST DEVELOPED FOR PROTECTION OF THE NECK AND OTHER PERIPHERAL REGIONS

John E. Murphy, Bruce H. Warren, and Edward R. Barron *In* AGARD Pattern Recognition. Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 13 p refs (See N69-34751 20-04)

Avail: CFSTI

The aircrew eq'mor was developed as a rapid response to a combat problem where UC-123 aircraft flying low level missions were sustaining small arms hits. Aircrewmen in these aircraft were receiving wounds from secondary missiles produced from the aircraft's plastic canopy and aluminum skin. Although they were wearing flak vests of various types, there was an urgent need for additional body protection, especially in the neck area. Special armor was developed and sent to Southeast Asia. Pilot attitudes toward wearing armor and user evaluations of the new armor were studied in 35 aircrewmen. The study included evaluations in UC-123, O-1, U-10, and A1E aircraft. Eighty percent of the aircrewmen interviewed had recent combat experience in Vietnam, and the group averaged 11.8 years of service and 10.7 years of flying experience. Collectively, the group had flown 8,775 combat missions and accumulated 13,660 combat hours. The study reports that USAF pilots want the best armor available but felt that the present body armor was only fair and improvements are needed. Author

N69-34763# Direction des Recherches et Moyens d'Essais, Paris (France).

PROTECTIVE BULLET-PROOF VEST [LE GILET DE PROTECTION PARE-BALLE]

G. C. Leomand *In* AGARD Pattern Recognition. Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 8 p In FRENCH (See N69-34751 20-04)

Avail: CFSTI

Background to the development of the modern protective bullet-proof vest is given and the final choice of the military, the chasuble form, is described. Shoulder straps of 14 cm. thick, layered nylon fabric join the front and back sections covering the superior portions of the body. Details of the unique construction include analysis of the plaquettes which are alveolar in type, of polyester-fiber glass, and the basic units which block penetration of a projectile. A general performance record from the field experience of service men is provided to demonstrate protection against grenades, various flying fragments, and direct impact. The psychological advantages and problems of adjustment to any long period of use are also discussed. Transl. by M.H.E.

N69-34764# Royal Air Force, Farnborough (England). Inst. of Aviation Medicine

DEVELOPMENT OF AN AIRCREW SAFETY HARNESS WITH SPECIAL REFERENCE TO THE F111 AIRCRAFT

D. C. Reader *In* AGARD Pattern Recognition. Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 6 p refs (See N69-34751 20-04)

Avail: CFSTI

The principles of safety harness design are discussed, and a method of harness assessment is presented. As an illustration the development and assessment of an alternative British harness for the F-111 is described. The British harness was compared with the American harness in experiments, conducted first at low levels of acceleration (1 G) and then at higher levels (up to 17 G) induced by swinging human subjects in a suspended replica seat and arresting the swing with cables. The improved restraint afforded by the British harness coupled with its operational advantages has led to its acceptance as a replacement for the American harness in all F-111 aircraft. Author

N69-34765# Naval Air Development Center, Johnsville, Pa. Aerospace Crew Equipment Dept.

PHYSIOLOGICAL ASSESSMENT OF AIRCREW PROTECTIVE SUIT SYSTEMS UNDER DIFFERENT ENVIRONMENTAL CONDITIONS

Louis J. SantaMaria *In* AGARD Pattern Recognition. Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 10 p refs (See N69-34751 20-04)

Avail: CFSTI

The protection of aircrew personnel under adverse environmental conditions encountered during the overall mission and potential emergency is a problem of continuing importance. Different protective suit systems (PSS) have been designed to satisfy requirements for environmental protection in the maintence of a physiologically tolerable level of thermal equilibrium in the in-flight condition, as well as in the emergency condition. The problem is further complicated by the very nature of the aircraft (helicopter, patrol, fighter, and attack), each endowed with peculiar conditioning systems and mission profiles. Among the PSS considered are the USN MK5A suit assembly, the divers' wet suit, and a polyvinylchloride suit. Simulated environments of extreme cold, both dry (−40°F temperature) and immersion cold (32°F water temperature), and moderate heat were induced in the physiological assessment of the various PSS. The adequacy of the protective suits under different conditions of exposure was based on measures of body temperature, heart rate, and weight loss. Author

N69-34766# Royal Air Force, Farnborough (England). Inst. of Aviation Medicine.

THE WATER COOLED SUIT

D. F. Ingram *In* AGARD Pattern Recognition. Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 6 p refs (See N69-34751 20-04)

Avail: CFSTI

Some literature on water cooled garments is reviewed. Several problems still await solution, of these the ability of skin sensation to guide the correct selection of inlet temperature to maintain thermal balance, and the effect of vasoconstriction on the performance of the suit are discussed in detail. Author

N69-34767# Naval Air Development Center, Johnsville, Pa. Aerospace Medical Research Dept.

FLASHBLINDNESS PROTECTION SYSTEM

Gloria T. Chisum *In* AGARD Pattern Recognition. Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 9 p (See N69-34751 20-04)

Avail: CFSTI

The inability to provide satisfactory protection from high intensity flashes of light by use of fixed density goggles, without at the same time severely reducing the light available for performance of visual tasks, led to a search for some alternative mode of protection. The ideal flashblindness protection system would be one which has an open transmission of one hundred percent, places no restriction on the field of view, immediately attenuates the light with a density just sufficient to prevent a change in vision with the onset of the flash and clears automatically as the light level is reduced. The ideal system is not in the forseeable future. The most recent development in flashblindness protection is the Navy Photometric System which provides a dynamic, indirectly actuated, automatically clearing goggle. The characteristics, advantages and disadvantages of the system are described. Author

N69-34772# Air Force Systems Command, Brooks AFB, Tex. Aerospace Medical Div.

FIRE PREVENTION AND PROTECTION IN OXYGEN ENRICHED ATMOSPHERES

Donald I. Carter *In* AGARD Pattern Recognition. Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 10 p refs (See N69-34751 20-04)

Avail: CFSTI

Fire safety aspects of ground-based simulators which use oxygen enriched atmospheres in research, testing and hyperbaric therapy are discussed. Improvements which have been made in removing combustible materials, in removing ignition sources and in providing fire extinguishing systems are emphasized. Author

N69-34786# Aktiebolaget Atomenergi, Stockholm (Swaden).

NUCLEAR CARDIAC PACEMAKERS

Göran Carleson and Lennart Svensson *In its* Nucl. Chem. May 1969 p 36–37 refs (See N69-34789 20-06)

Avail: CFSTI

A cardiac pacemaker prototype powered by an isotopic battery is being developed and manufactured. Various design parameters and gamma sterilization problems have been studied. Author (ESRO)

N69-34980# Joint Publications Research Service, Washington, D.C.

MAN UNDER WATER

A. Smukul 7 Aug. 1969 5 p Transl. into ENGLISH from Tekhn. Vooruzheniye (USSR), no. 6, 1969 p 28–29

(JPRS-48575) Avail: CFSTI

A general discussion of Russian experience on man's acclimatization underwater includes a brief account of three scientific underwater experiments submerged at no greater depth than 60 m. A statement of purpose, problems posed by the autonomous underwater laboratory, individual equipment for aquanauts, and means of communication and transportation are briefly discussed. The design of life support systems which answer every technical need as well as providing comfortable normality to the living conditions is cited as the most pressing problem posed by man under water. A prototype closed-system respiratory apparatus is previewed in which the gas mixture is inhaled from one sack and exhaled into another sack. M.H.E.

N69-35024*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EFFECTS OF DIFFERING AMOUNTS OF TRAINING AND OF MONOCHROMATIC TARGETS ON SEXTANT SIGHTING PERFORMANCE

Emmett C. Lampkin and Robert J. Randle Washington Aug. 1969 10 p refs

(NASA-TN-D-5190) Avail: CFSTI CSCL 05I

Sighting performance using a standard marine, gimbal mounted sextant with a special telescope substituted for the eyepiece was studied in combinations of simulated monochromatic stars. The stars were simulated by projecting a point source of light onto a parabolic mirror. The point source was provided by placing a lamp behind a 0.0005-inch-diameter aperture and positioning it at the focal point of the parabolic mirror. The collimated image of the aperture being projected was perceived as a star at infinity. The combinations of stars studied were: red-red, white-white, and red-green. It is concluded that five days of training are sufficient for achieving a performance asymptote; and monochromatic stars may be used for sextant sightings, with performance being more consistant from the red end of the spectrum. A discussion of the results is presented. F.O.S.

N69-35027*# National Aeronautics and Space Administration, Washington, D.C.
ON THE PROFESSIONAL ACTIVITY OF A COSMONAUT [O PROFESSIONALVIOY DEYATELVIOSTI KOSMOIAVTA]
Yu. Gargarin Aug. 1969 8 p Transl. into ENGLISH from Aviats. i Kosmonavt. (Moscow), no. 4, 1969 p 9–11
(NASA-TT-F-12433) Avail: CFSTI CSCL 05I

The contents concern a new profession, the cosmonaut. Covered are training techniques, education, and work. Also described are some of the sophisticated instruments and tests given the cosmonaut for physical and mental endurance. The purpose of the cosmonaut profession, as described by the author, is to provide new laws and increase the understanding of the universe, and this knowledge is to be used for the good of all man. E.H.W.

N69-35094*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SAFETY EQUIPMENT FOR HANDLING THE 20-kW AND 5-kW ARC LAMPS
Maurice J. Argould 15 Apr. 1969 47 p
(Contract NAS7-100)
(NASA-CR-104085; TM-33-429) Copyright. Avail: CFSTI CSCL 06K

The 20-kW xenon compact arc lamp used as the energy source for the simulated solar system in the 25-ft space simulator has an internal pressure of approximately 4.2 atm (47 psig) at room temperature; at operating temperature, its pressure increases to approximately 10 atm (132 psig). For this reason, safety equipment must be supplied for the men who work around these lamps. Several tests were conducted on protective clothing exposed to the breaking of quartz envelopes identical to those used in the manufacture of compact xenon arc lamps. Quartz envelopes and two pyrex tubes similar to the lamps were broken at 45 psig. Articles of protective clothing and different types of materials were exposed to the lamp and then inspected for marks and cuts. After modification, the test was repeated with very encouraging results. A verification test of face shield and leather gloves was performed to prove safety with a more direct explosion impact. Other tests were run to evaluate different methods of approach for personnel protection and to establish safety requirements for the 5-kW arc lamp. Author

N69-35266# Stanford Linear Accelerator Center, Calif.
FORMAL DESCRIPTION FOR TWO-DIMENSIONAL PATTERNS
C. T. Zahn Mar. 1969 8 p refs Presented at Intern. Joint Conf. on Artificial Intelligence, Washington, D.C., 7-9 May 1969 Sponsored by AEC
(SLAC-PUB-538; CONF-690511-1) Avail: CFSTI

A structural description for two-dimensional black and white patterns is defined as the set of contour lines for an appropriate function which fits the binary pattern. These contour lines are mutually non-intersecting closed polygonal curves with edges in only eight different directions and they represent the boundaries between connected black and white areas of the pattern. Rigorous procedures are described to transform a matrix pattern into a structural description and vice versa. Advantages of this method for describing patterns previous to pattern recognition are discussed at some length. Author (NSA)

N69-35540*# McDonnell-Douglas Co., Huntington Beach, Calif.
REQUIREMENTS STUDY FOR A BIOTECHNOLOGY LABORATORY FOR MANNED EARTH ORBITING MISSIONS. VOLUME 2: SUMMARY OF INDIVIDUAL EXPERIMENTS REQUIREMENTS
L. T. Kail Washington NASA Aug. 1969 205 p refs
(Contract NAS7-518)
(NASA-CR-1409; DAC-58156) Avail: CFSTI CSCL 06B

This volume summarizes the requirements of each experiment used in establishing the biotechnology requirements described in Volume I of this report. The requirements for each experiment are presented in four sections: (1) biomedical and human research; (2) behavioral research; (3) bioscience research; and (4) life support and protective systems. The experiment title, category, and assigned number relate directly to the research program discussed in Volume 1, Section 2. Author

N69-35541*# McDonnell-Douglas Co., Huntington Beach, Calif.
REQUIREMENTS STUDY FOR A BIOTECHNOLOGY LABORATORY FOR MANNED EARTH ORBITING MISSIONS. VOLUME 1: RESULTS, RECOMMENDATIONS AND REQUIREMENTS
L. T. Kail Washington NASA Aug. 1969 169 p
(Contract NAS7-518)
(NASA-CR-1408; DAC-58155) Avail: CFSTI CSCL 06B

The objective of the study presented here was to expand and incorporate the results of past studies, into an all-encompassing life science research program (gap-filling as required) to identify manned Earth-orbital life science laboratory equipment requirements for the 1970's. Another objective of the study was to identify and integrate requirements that are common to the four life science research fields of biomedicine and human research, behavior, bioscience, and life support systems. An elementary sketch of a concept for a biotechnology laboratory as part of a multipurpose space station is shown. The individual equipment items required in the "laboratory area" are described. The centrifuge shown relates to requirements of experiments considered in this report and represents another program currently under study by NASA for life sciences research. This study has addressed itself to the total research activities and equipment encompassed by such a laboratory. The results of the study provide a basis for further definition of a facility. Author

N69-35654*# National Aeronautics and Space Administration, Washington, D.C.
AMERICA IN SPACE: THE FIRST DECADE. LINKING MAN AND SPACECRAFT
William R. Corliss 1 Oct. 1969 20 p refs
(NASA-EP-56) Avail: SOD $0.40; CFSTI CSCL 05H

Methods, systems, equipment, and facilities used by NASA for transferring information between spacecraft and the earth are described. This includes summaries of the man-machine communication system from spacecraft sensors to the final user of the data; power sources and transmission problems; use of bits, codes, and communication languages; real-time and delayed-time transmissions; data acquisition; NASA control centers; and data processing and evaluation on the ground. K.W.

N69-35837*# Univis, Inc., Dudley, Mass.
DESIGN, DEVELOPMENT AND PRODUCTION OF PRESSURE SUIT SPECTACLES Final Report
Albert J. Laliberte ed 1 Jul. 1969 56 p
(Contract NAS9-9090)
(NASA-CR-101860) Avail: CFSTI CSCL 06K

Spectacles having various attenuative and transmissive characteristics in the ultraviolet, visible, and infrared regions are described. A spectacle frame structure was designed meeting requirement of the anthropometric 95 percentile head and includes a self-adjusting bridge, metal temples with slotted spatula endpieces,

and an elastic headband strap. The spectacle front is fabricated from 1/10 12 karat gold filled metal composition. The frames are fitted with plastic lenses, cast from thermosetting CR-39 (allyl digylcol carbonate) resin, and having plano optics. The spectacle assemblies are fabricated in three types, each with a large and a medium bridge. Type 1 has clear lenses attenuating ultraviolet radiation and has visible transmittance in the order of 90%. Type 2, fitted with grey tint lenses, has a visible transmittance of 10% and provides attentuation in the ultraviolet and visible regions. Type 3 has gold-coated bidensity lenses with visible transmittance in the upper gold-coated area of 2% and in the uncoated area of 10%, and provides attenuation in all three regions in the upper lens and in the ultraviolet and visible regions in the bottom lens. Author

N69-38960# Army Aeromedical Research Unit, Fort Rucker, Ala.
SELECTED ANTHROPOMETRIC MEASUREMENTS OF 1640 US ARMY WARRANT OFFICER CANDIDATE FLIGHT TRAINEES
William P. Shane, Delvin E. Littel, Charles G. Moultrie Feb. 1969 76 p refs
(AD-688856; USAARL-69-2) Avail: CFSTI CSCL 5/5

The results of nine anthropometric measurements conducted upon 1,640 U. S. Army warrant officer candidates are presented. The nine measurements were selected as those which contribute most to aircrew workspace design in aircraft. Comparison of these data was performed against similar measurements conducted upon flying personnel in five separate studies by other military services. Author (TAB)

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N69-34606# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
OXIDATION OF NEPTUNIUM (V) IN NITRIC ACID SOLUTION: LABORATORY STUDY OF RATE ACCELERATING MATERIALS (RAM)
J. L. Swanson Apr. 1969 29 p refs
(Contract AT(45-1)-1830)
(BNWL-1017) Avail: CFSTI

Oxidation of neptunium(V) to neptunium(VI) can be accelerated by the addition of rate accelerating materials (RAM). These materials that accelerate oxidation of neptunium(V) in HNO_3-HNO_2 solutions are obtained by reacting the aci-form of 1-nitropropane with HNO_3 in the presence of nitrite. The preparation of this material and its effect on the oxidation rate were studied in detail. The data indicate that addition of a low concentration of RAM could increase the rate of neptunium(V) oxidation by several orders of magnitude. The extractability and stability to radiation of RAM appear to be adequate for plant use, and tests indicate that it has no effect on the solvent extraction behavior of plutonium or fission products or on phase disengaging times. Author (NSA)

N69-34821*# Arizona Univ., Tucson.
NOTES ON LIQUID-FILTER CELLS
S. F. Pellicori *In its* Commun. of the Lunar and Planetary Lab., Vol. 8, Pt. 2 1969 p 97-98 refs (See N69-34613 20-30)
Avail: CFSTI CSCL 07D

Design and use of a leakproof liquid-filter cell is described. The particular features of this cell are: (1) ease of assembly; (2) maximum liquid path per cell thickness availability, because the bottom of the cell body can be made very thin (0.5mm or less); (3) maximum aperture-to-cell diameter ratio provision; and (4) a black-dyed, sulfuric-anodized aluminum cell and black or red Teflon used to reduce scattered light. Author

N69-34630# Oak Ridge National Lab., Tenn. Reactor Div.
THE APPLICATION OF DETACHED TURBULENCE PROMOTERS TO A TUBULAR HYPERFILTRATION SYSTEM WITH DYNAMICALLY FORMED MEMBRANES
William R. Mixon (M.S. Thesis — Tenn. Univ., Knoxville) Mar. 1969 177 p refs Sponsored by AEC
(PB-183454; ORNL-TM-2150) Avail: CFSTI CSCL 07D

The effect of detached turbulence promoters on the performance of a tubular hyperfiltration (reverse osmosis) membrane was determined for a Reynolds number range of 1,100 to 40,000. The brine feed was a solution of $MgCl_2$ with a pH of about three and the dynamic, salt rejecting membrane was formed inside a porous carbon tube by the additive hydrous Zr(IV) oxide. The promoters tested consisted of continuous wire coils, with and without longitudinal wire runners attached to the outer coil surface. The effectiveness of each promoter was based on the ratio of the Chilton-Colburn j factor for mass transfer of a promoted tube section to that of an unpromoted tube section at equal Reynolds number, which was defined as the promotion factor. USGRDR

N69-34631# California Univ., Berkeley. Lawrence Radiation Lab.
INFRARED SPECTRA AND REACTION KINETICS OF FREE RADICALS IN THE CHLORINE--OXYGEN
Jack M. Van den Bogaerde (Ph.D. Thesis) Jan. 1969 155 p refs
(Contract W-7405-ENG-48)
(UCRL-18682) Avail: CFSTI

Utilizing the technique of chemical-modulation infrared spectrometry to study the gas phase photolysis of Cl_2 in the presence of O_2, an absorption spectrum attributable to the ClOO peroxy radical was detected and recorded. Spectroscopic evidence for the assignment lies in the near coincidence of the peak band intensity, at 1443/cm, with a fundamental vibrational frequency of matrix-isolated ClOO of 1441/cm. The observed second-order decay of the ClOO radical was consistent with the generally accepted mechanism for the formation and disappearance of this species in Cl_2-O_2 mixtures. Author (USGRDR)

N69-34650# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
TRANSPORT PROPERTIES OF SILVER TELLURIDE AT HIGH TEMPERATURES IN THE SOLID AND LIQUID STATES [TELLURURE D'ARGENT AG SUB 2 TE AUX HAUTES TEMPERATURES A L'ETAT SOLIDE ET A L'ETAT LIQUIDE]
Ngu Tung Pham (Ph.D. Thesis--Paris Univ., 10 Jan. 1969) May 1969 94 p refs In FRENCH; ENGLISH summary
(CEA-R-3780) Avail: CFSTI

Measurements of the electrical resistivity, Hall coefficient and thermoelectric power have been carried out for silver telluride over a large temperature range including both solid and liquid states. The analysis of the experimental data shows that in the solid state the transport properties are governed by an ambipolar process with an electron mobility much higher than the hole mobility ($n \sim 10$ p). It is found that the temperature dependence of the electron mobility can be represented by a $T^{-3/2}$ law. Deviations from the stoichiometric composition Ag_2Te have been studied. For

all specimens, melting is accompanied by discontinuous variations in the transport properties. Above the melting point, the magnitude of the measured parameters and their temperature dependence show that liquid silver telluride behaves as a semiconductor. The contribution of Ag^+ ions to transport phenomena is suggested to account for the behavior of the electrical properties. Experimental data have been analyzed in terms of conventional theories. Author (ESRO)

N69-34854# Bosch (Robert) G.m.b.H., Stuttgart (West Germany). Laboratorien für Physik und Elektrochemie.
INVESTIGATIONS OF THE SULPHATE DISTRIBUTION IN LEAD ACCUMULATOR PLATES BY MEANS OF RADIOACTIVE SULPHUR ISOTOPE S^{35} [UNTERSUCHUNGEN UEBER DIE SULFATVERTEILUNG IN MASSEPLATTEN VON BLEIAKKUMULATOREN MIT HILFE DES RADIOAKTIVEN SCHWEFEL-ISOTOPS S^{35}]
Hermann Leibesle, Harald Reber, Werner Herrmann, and Ernst Zehender *In its* Tech. Rept., Vol. 2, No. 4 Jun. 1968 p 159–183 refs In GERMAN; ENGLISH summary (See N69-34853 20-34)
Avail: CFSTI

The influence of charge/discharge cycles on the life and the capacity of lead automobile storage batteries is studied by determining the lead sulfate distribution in the positive plate using the radioactive sulfur isotope S^{35} as a label in order to estimate the influence of reducing the antimony content of the battery plates. ESRO

N69-34859# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
CONTRIBUTION TO THERMODYNAMICS AND KINETICS OF ARGON, KRYPTON AND XENON AT VERY LOW TEMPERATURES [CONTRIBUTION A L'ETUDE THERMODYNAMIQUE ET CINETIQUE DE L'ARGON, DU KRYPTON ET DU XENON AUX TRES BASSES TEMPERATURES]
Léonard L. Stevenson (Ph.D. Thesis–Paris Univ.) Apr. 1969 213 p refs In FRENCH; ENGLISH summary
(CEA-R-3660) Avail: CFSTI

The condensation theories of Zwanzig, Cabrera, McCarroll and Ehrlich, Wanlass, Armand, and Yu and Soo are critically reviewed. A condensation coefficient of unity is predicated by all except the last two theories, when the temperature of the gas impinging on its own solid phase is equal or less than 300°K. Experimental data obtained with a resonating quartz microbalance (sensitivity: 109 g.cm2) agreed with these theories when the temperature of the solid was less than 20°K. However the agreement must be discussed for the more sophisticated theories of Armand and Yu and Soo. The sublimation of rare gases has been considered by Salter, Eyring, Goodman and Armand and within an order of magnitude the experimental data agree with the expected values. In addition Armand's theory gives a physical meaning to argon sublimation from a krypton or a xenon crystalline substrate as localized modes of surface vibration occur. The relaxation time for the complete thermalization of an argon deposit on krypton is more than twelve hours at 25x19 K. Author (ESRO)

N69-34882*# Techtran Corp., Glen Burnie, Md.
INSERTION REACTIONS OF ISONITRILES
Takeo Saegusa et al Washington NASA Aug. 1969 25 p refs Transl. into ENGLISH from Yuki Gosei Kagu (Tokyo), v. 26, no. 10, 1968 p 862–873
(Contract NASw-1695)
(NASA-TT-F-12411) Avail: CFSTI CSCL 07C

The insertion reactions of isonitriles using metal salts particularly copper compounds and of isonitriles based on radical catalysts are described. Combinations of metal compounds and isonitriles form special, promising catalytic system. Author

N69-34884*# Arnic School of Languages, Inc., Maynard, Mass. Research Translation Div.
RADIOCRYSTALLOGRAPHIC STUDY OF THE STRUCTURE OF A CARBON DIOXIDE CRYODEPOSIT [ETUDE RADIOCRISTALLOGRAPHIQUE DE LA STRUCTURE D'UN CRYDEPOT DE CARBON DIOXIDE]
R. Graft et al Washington NASA Aug. 1969 8 p refs Transl. into ENGLISH from Rech. Aerospatiale (France), no. 123, 1968 p 81–84
(Contract NASw-1682)
(NASA-TT-F-12533) Avail: CFSTI CSCL 07D

The X ray study of a CO_2 cryodeposit trapped on a wall cooled by liquid nitrogen shows that this deposit is crystallized. At pressure levels on the order of 10^{-2} mb, the deposit obtained may present a well marked texture, the lattice planes (111) of carbon dioxide then being parallel to the support. Author

N69-34886# Illinois Univ., Urbana.
VACUUM ULTRAVIOLET PHOTOCHEMISTRY OF PROPANE ABOVE AND BELOW IONIZATION
Arthur Lonne Lane (Ph.D. Thesis) 5 Sep. 1968 341 p refs Sponsored in part by AEC
(CALT-532-35) Avail: CFSTI

The vacuum ultraviolet photochemistry of propane was studied above and below its first ionization potential (10.95 eV) with monochromatic light sources. Pure propane and neon-propane mixtures were photolyzed at several different pressures with light of 1236 Å (10.03 eV) and 1048 to 1067 Å (11.62 – 11.83 eV) over a decomposition range of 0.02 to 1%. Product analyses were performed by flame ionization gas chromatography and mass spectrometry. Product distributions were obtained with estimated errors of ±3% at 1236 Å and ±8% at 1048 to 1067 Å. The absorption coefficients and ionization efficiencies of propane were measured at the wave-lengths of interest. The absorption coefficients are α(1067 Å) = 1410 atm-1 cm-1, and α(1048 Å) = 1430 atm-1 cm-1. The ionization efficiencies are I.E. (1067 Å) = 20% and I.E.(1048 Å) = 30%. The accuracy of these measurements is ±10%. The results show that translationally hot H atoms formed in the primary or secondary dissociations are thermalized before they react. Author (NSA)

N69-34887# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
DYNAMIC ELECTRON MICROSCOPY OF HIGH-TEMPERATURE REACTIONS
S. J. Meyhan and J. L. Daniel 31 Jul. 1968 41 p refs Presented at 14th Natl. Symp. of the Soc. of Aerospace Mater. and Process Engr., Cocoa Beach, Fla.
(Contract AT(45-1)-1830)
(BNWL-SA-1565; CONF-681126-1) Avail: CFSTI

Electron microscopy facilities for high temperature materials studies are described. A furnace for in-microscope heating, a gas chamber for studying chemical reactions, and equipment for studying radioactive samples are briefly described. Transmission, reflection, and scanning electron microscopy techniques are considered, and cinema photography methods are discussed. Some time series electronmicrographs of high-temperature structural and nuclear fuel materials are presented. NSA

N69-34696# Bosch (Robert) G.m.b.H., Berlin (West Germany).
QUANTITATIVE MICROANALYTIC DETERMINATION OF RUTHENIUM, PLATINUM, AND ALUMINUM IN ALLOYS AND SOLID SOLUTIONS [QUANTITATIVE MIKROBESTIMMUNG VON RUTHENIUM, PLATIN UND ALUMINIUM IN LEGIERUNGEN UND FESTEN GEMISCHEN]
Peter Schemer and Detlef Baresel *In its* Tech. Rept., Vol. 2, No. 6 Dec. 1968 p 263-267 refs In GERMAN; ENGLISH summary (See N69-34695 20-34)
Avail: CFSTI

Ruthenium containing alloys, as used in fuel cells, do not dissolve easily in the usual noble metal solvents. For this reason, decomposition in a glass bomb oven in the presence of potassium disulfate and potassium chloride at 530°C was used. After distillation of RuO_4 from Pt and Al, the Ru was photometrically determined down to quantities as low as 2 micrograms. ESRO

N69-34724# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CONTRIBUTION TO THE STUDY OF THE DEGRADATION OF PHENOLIC RESINS [CONTRIBUTION A L'ETUDE DE LA DEGRADATION DES RESINES PHENOLIQUES]
Genevieve Gautherot (Ph.D. Thesis-Paris Univ., Paris) 1969 62 p refs In FRENCH; ENGLISH summary
(ONERA-P-127) Avail: CFSTI

The study was carried out by means of gas analysers by infrared absorption, with which it is possible to analyse continuously the volatile products (CO, CO_2, CH_4, H_2, H_2O) during decomposition. The repeatability of the resins was assumed by a thorough normalization of the polycondensation reactions, and by a special reticulation technique in an inert atmosphere, the material being reduced to a thin film. The degradation of five samples, three resols and two novolaques, were obtained in an inert atmosphere, either by programmed heating or at constant temperature. Indirect titration systems were developed for recording the hydrogen and water emanation from the gas analysers. The graphs obtained give total gas quantities varying according to the nature, the chemical composition and the preparation method of the resins. They make possible the determination of the temperatures at which each gaseous emanation is initiated, reaches its maximum, and becomes evanescent. Spectral analyses of the solid residuum were made at these temperatures, and have shown a correlation between the structural variations of the resins during decomposition and the gaseous emanations. These results, added to the elementary analysis of the residuum and to the thermogravimetric analysis of the resins, led to the definition of a formation mechanism of the volatile products. Author

N69-34742*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
THERMODYNAMIC THEORY OF THE GRAVITATIONAL EFFECT IN BINARY MIXTURES [TERMODINAMICHESKAY TEORIYA GRAVITATSIONNOGO EFFEKTA V BINARNYKH SMESYAKH]
Yu. P. Krasnyi et al Washington NASA Aug. 1969 6 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 14, no.2, p 257-261
(Contract NASw-1692)
(NASA-TT-F-12397) Avail: CFSTI CSCL 07D

A theoretical study of the change in the binary mixture concentration along the tube near its liquid-vapor critical point is presented. The possibility is shown of the existence of an unmonotonous change in the concentration of a binary mixture. The conditions under which this unmonotony takes place are also presented. Author

N69-34746# United Kingdom Atomic Energy Authority, Harwell (England). Applied Sciences Div.
DETERMINATION OF SULPHUR IN NICKEL
A. Parker, C. G. Wallace, and T. J. Webber Mar. 1969 13 p refs
(AERE-R-6009) Avail: CFSTI; HMSO: 2s 6d

A method is described for determination of microgram quantities of sulphur in nickel. The metal is dissolved in nitric acid containing bromine, the nitrate ions are removed, and a chloride solution of the nickel is treated with a titanous phosphate/phosphoric acid mixture in a stream of nitrogen. The evolved hydrogen sulphide is collected, reacted with p-phenylenediamine in the presence of ferric chloride, and the absorbency of the resultant Lauth's violet is measured. The coefficient of variation at the 130 ppM level using a 0.25-g sample is 8% and the limit of detection is 2 μg of sulphur. Up to 1 g of metal can be used per determination. Author (NSA)

N69-34787# California Univ., Berkeley. Lawrence Radiation Lab.
ORGANIC CHEMISTRY AND GEOCHEMISTRY
In its Chem. Biodyn. 1 Jun. 1968 p 81-98 refs (See N69-34784 20-04)
Avail: CFSTI

The 1,2-dithiane-3-carboxylic acid and 1,2-dithiane-4-carboxylic acid were synthesized and resolved into optical antipodes via alkaloid salts. Their rotatory powers are shown to be of the same magnitude. The absolute configuration of this first acid was determined by synthesis from ornithine, and that of the second by Raney desulfurization. Algal oozes, and charge transfer complexes with hexafluorobenzene and pentafluorobenzonitrile as acceptor components are discussed. F.O.S.

N69-34788# California Univ., Berkeley. Lawrence Radiation Lab.
PHOTOCHEMISTRY AND RADIATION CHEMISTRY
In its Chem. Biodyn. 1 Jun. 1968 p 99-112 refs (See N69-34784 20-04)
Avail: CFSTI

The photolysis of 2, 3, 3-triphenyloxaziridines, and the irradiation of benzene with carbon 14 atoms are discussed. The electron spin resonance spectra resulting from hydrogen atom irradiation of crystalline choline chloride are studied. F.O.S.

N69-34789# Aktiebolaget Atomenergi, Stockholm (Sweden).
NUCLEAR CHEMISTRY Progress Report, 1968
May 1969 38 p refs
(AE-360) Avail: CFSTI

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2. RADIOLYSIS OF AQUEOUS SOLUTIONS AND ICE H. Christensen and G. Nilsson (Atomic Energy Comm. Res. Establ., Risoe, Denmark) p 9-16 refs (See N69-34791 20-06)

3. PREPARATION OF VINYL MONOMER SINGLE CRYSTALS AND THE STUDY OF THEIR RADIATION INDUCED POLYMERIZATION T. Gillbro and P.-O. Kinell p 17-20 ref (See N69-34792 20-06)

4. WOOD POLYMER COMBINATIONS P. Aagaard p 21-23 refs (See N69-34793 20-06)

5. NEUTRON AND PHOTONUCLEAR ACTIVATION ANALYSIS S. Mattsson, K. Liden (Lund Univ.), and D. Brune p 24-26 refs (See N69-34794 20-06)

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N69-34795 20-06)
7. NUCLEAR CARDIAC PACEMAKERS G. Carleson and L. Svensson p 38–37 ref (See N69-34796 20-05)

N69-34790# Aktiebolaget Atomenergi, Stockholm (Sweden).
ISOTOPE EFFECTS IN SALT-WATER SYSTEMS
Karl Erik Holmberg *In its* Nucl. Chem. May 1969 p 5–8 refs (See N69-34789 20-06)
Avail: CFSTI

The systematic investigation of phase diagrams of inorganic salts in light and heavy water at medium and low temperature has proceeded according to plan. Solubilities have been determined mainly for alkali and alkaline earth metal halides. A connection between solubilities and water structure in the salt solutions formed has been observed. Author (ESRO)

N69-34791# Atomic Energy Commission Research Establishment, Riso (Denmark).
RADIOLYSIS OF AQUEOUS SOLUTIONS AND ICE
Hilbert Christensen and Gosta Nilsson *In* Aktiebolaget Atomenergi Nucl. Chem. May 1969 p 9–16 refs (See N69-3478 20-06)
Avail: CFSTI

Spectra of H and OH radicals as well as other transients have been recorded, and their rate constants determined by pulseradiolytic technique in aqueous solutions of aniline and other admixtures. Trapped electrons and OH radicals are being studied with the same technique in H_2O ice and D_2O ice at various temperatures. Decay kinetics and G values have been calculated. Aqueous solutions of benzene and toluene have also been investigated after gamma radiolysis. Author (ESRO)

N69-34792# Aktiebolaget Atomenergi, Stockholm (Sweden).
PREPARATION OF VINYL MONOMER SINGLE CRYSTALS AND THE STUDY OF THEIR RADIATION INDUCED POLYMERIZATION
Tomas Gillbro and Per-Ofol Kinell *In its* Nucl. Chem. May 1969 p 17–20 ref (See N69-34789 20-06)
Avail: CFSTI

The radiation induced polymerization in single crystals of vinyl-monomers, prepared according to a method which is described, is being studied by means of ESR technique. Evidence for radical pair formation has been observed. X-ray diffraction analysis is used to determine the crystal structures, thereby contributing to a more complete interpretation of the ESR spectra. Author (ESRO)

N69-34793# Aktiebolaget Atomenergi, Stockholm (Sweden).
WOOD POLYMER COMBINATIONS
Per Aagaard *In its* Nucl. Chem. May 1968 p 21–23 refs (See N69-34789 20-06)
Avail: CFSTI

The polymerization efficiency as well as the formation of grafting and homopolymers in wood polymer combinations between native Scandinavian woods and vinyl or/and polyester monomers have been studied as a function of total dose, dose rate, diluting agents, and humidity. Erratic reproducibility was observed for the pine-methylmethacrylate system which makes this material less useful in industrial applications. Author (ESRO)

N69-34794# Aktiebolaget Atomenergi, Stockholm (Sweden).
NEUTRON AND PHOTONUCLEAR ACTIVATION ANALYSIS
Dag Brune, Sören Mattsson (Lund Univ.) and Kurt Liden (Lund Univ.) *In its* Nucl. Chem. May 1969 p 24–26 refs (See N69-34789 20-06)
Avail: CFSTI

Neutron and photonuclear activation analysis, partly in combination with a low temperature technique, have been used to determine micro amounts of iodine and some other elements in pharmaceuticals and biological tissue. A special geometrical arrangement was adapted for multiple sample irradiation. Author (ESRO)

N69-34796# Aktiebolaget Atomenergi, Stockholm, (Sweden).
INORGANIC ION EXCHANGERS
Sten Ahrland (Lund Univ.), Göran Carleson, and Erik-Ake Tranberg *In its* Nucl. Chem. May 1969 p 27–35 refs (See N69-34789 20-06)
Avail: CFSTI

Methods for the preparation of inorganic ion exchangers of zirconium phosphate type with a very low phosphate leakage even at high temperatures have been discovered. The crystallinity of the resin was found to have a profound influence and was studied in detail. Zirconium hydroxide gels were also prepared and their affinities towards various anions studied. An investigation of the radiation stability of inorganic ion exchangers in the dose range $1–10^5$ Mrads has recently started. Author (ESRO)

N69-34810*# Pennsylvania Univ., Philadelphia. Inst. for Direct Energy Conversion.
INSTITUTE FOR DIRECT ENERGY CONVERSION Status Report
Dec. 1968 62 p refs (Grant NGL-39-010-001) (NASA-CR-103989; INDEC-SR-15) Avail: CFSTI CSCL 07D

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1. MATERIALS ENGINEERING 18 p refs (See N69-34811 20-06)
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3. ELECTROCHEMICAL ENGINEERING 17 p ref (See N69-34813 20-06)

N69-34811*# Pennsylvania Univ., Philadelphia. Inst. for Direct Energy Conversion.
MATERIALS ENGINEERING
In its Inst. for Direct Energy Conversion Dec. 1968 18 p refs (See N69-34810 20-06)
Avail: CFSTI CSCL 07D

The solution of the equation for transient conduction in a simple geometry produced the thermal diffusivity of solids from measured temperature distribution as a function of time. An analysis of the transient temperature response of cylindrical, composite energy storage devices whose thermal conductivity, density, and specific heat are independent of temperature is also presented. Experimental determination of the thermoelectric properties of graphite alloys, superconductivity in evaporated tungsten films, and boiling thermionic converters are discussed. J.A.M.

N69-34813*# Pennsylvania Univ., Philadelphia. Inst. for Direct Energy Conversion.
ELECTROCHEMICAL ENGINEERING

In its Inst. for Direct Energy Conversion Dec. 1968 17 p ref (See N69-34810 20-06)
Avail: CFSTI CSCL 07D

Using the bilinear transformation of coordinator, the cylindrical configuration was reduced to one of concentric circles for which the current distribution was solved and expressed in the original geometry in terms of simple analytical expressions. This was applied to fuel cell designs. The improved design of the foam fuel cell was used for anodic oxidation studies of hydrogen in 4N H_2SO_4 on bright, smooth platinum electrodes. The iodine cathode composed of graphite and magnesium in fuel cells is discussed, including its leadage which was a major retarding factor due to the incompatibility of most materials with iodine. Overpotential transients on the rotating disk are also assessed. J.A.M.

N69-34844# California Univ., Berkeley. Lawrence Radiation Lab.
A MASS SPECTROMETRIC STUDY OF THE SUBLIMATION OF CHROMIUM TRIOXIDE
Charles Adelbert Washburn (Ph.D. Thesis) Feb. 1969 133 p refs
(Contract W-7405-ENG-48)
(UCRL-18685) Avail: CFSTI CSCL 07D

CrO3 (s) is metastable, even at room temperature, relative to decomposition to Cr2O3 (s) and O2 (g). However the decomposition reaction is strongly kinetically suppressed, and, in fact, CrO3 (s) sublimes congruently or nearly congruently below its melting point (196C). The vapor species in addition to O2 are Cr_nO_{3n} = 3, 4, 5, and 6; Cr_nO_{3n-2} n = 3, 4, and 5. In addition, small quantities of Cr_4O_{11} and Cr_3O_8 are probably present in the vapor. In addition to ions corresponding to the molecules mentioned above, ions of the following compositions were detected in the mass spectrum resulting from the sublimation of CrO3 (s) but were determined to be fragments of heavier molecules: Cr_4O_9 (+), Cr_4O_8 (+), Cr_4O_7 (+), Cr_3O_6 (+), Cr_3O_5 (+), Cr_3O_4 (+), Cr_2O_5 (+), Cr_2O_4 (+), and Cr_2O_3 (+). USGRDR

N69-34845# Sandia Corp., Albuquerque, N. Mex.
STUDIES OF SOLUTE-SOLVENT INTERACTIONS IN NON-AQUEOUS SOLVENTS, 1 JULY 1968 - 1 JANUARY 1969
N. E. Vanderborgh and W. D. Spall 1 Jan. 1969 65 p refs
(SC-CR-3093; PB-183117) Avail: CFSTI CSCL 07D

This report describes progress in the study of solute-solvent interactions in non-aqueous, aprotic solvents of low dielectric constant. The report is divided into three sections which describe the majority of the work completed: Association of phenolic compounds, in benzene solution; Design and construction of an ultrasonic absorption cell; Extended Huckel Molecular Orbital Calculations on a series of phenols. USGRDR

N69-34857*# Heliodyne Corp., Van Nuys, Calif.
OPTICAL CONSTANTS OF CARBON-HYDROGEN MIXTURES Final Report
Roger P. Main 20 May 1969 204 p refs
(Contract NAS3-11842)
(NASA-CR-72570) Avail: CFSTI CSCL 07D

The equilibrium compositions, linear spectral absorption coefficients, and Planck and Rosseland mean absorption coefficients were computed for carbon-hydrogen mixtures with carbon/hydrogen mass ratios of 0.005, 0.01, and 0.05, temperatures of 1600, 2200, 3000, 4000, 5000, 6500, 8000, and 10,000°K, and gas pressures of 100, 500, and 1000 atmospheres for the wave number range 7000 - 68,000 cm^{-1} (approximately). The possible presence of condensed carbon was considered in the composition calculations, but none was found. The major absorption was found to be due to molecular electronic transitions in H_2, CH_3, C_2H, and C_2H_4, and to H^- photodetachment and neutral free-free processes, although each did not contribute strongly for all of the temperatures, pressures, C/H mass ratios, and spectral frequencies considered. Author

N69-34869# Commissariat a l'Energie Atomique, Fontenay-Aux-Roses (France). Centre d'Etudes Nucleaires.
FLUORIDE COMPLEXES OF HEXAVALENT NEPTUNIUM
Rene Sontag and Claude Musikas 1968 21 p refs Presented at the 11th Intern. Conf. on Coord. Chem. Haifa (Israel), 8-12 Sep. 1968
(CEA-Conf-1266; Conf-680912-4) Avail: AEC Depository Libraries

Potentiometry at an imposed current can be used to determine dissociation constants of fluorhydric complexes of hexavalent neptunium. Reproducibility of the results are comparable to those obtained by other methods. The values of dissociation constants using potentiometry at null current as well as imposed current were found to be nearly the same (0.11 and 0.12, respectively). Hexavalent neptunium fluorhydric complexes are less stable than the corresponding uranium complexes. This fact can be compared with the observation made for the sulfuric complexes of UO^{2+}_2 and NpO^{2+}_2 ions. The overall reaction $NpO^{2+}_2 + FH \rightleftharpoons FNpO^{+}_2 + H^+$ is exothermic and occurs with a decrease in entropy. If the ΔH and ΔS values for the reaction $F^- + H^+ \rightarrow FH$ are taken into account, it can be seen that the association of NpO^{2+}_2 and F^- is exothermic and occurs with a slight increase in entropy. This increase is comparable with other aqueous complexing reactions involving fluoride ions. Author (NSA)

N69-34870# Vsesoyuznyi Nauchno-Issledovatelskii Institut Radiatsionnoi Tekhniki, Moscow (USSR).
ROENTGENORADIOMETRIC EQUIPMENT AND METHODS OF RAPID-ANALYSIS FOR COPPER, IRON, AND OTHER ELEMENTS
S. V. Mamikonyan, O. V. Kozlov, and L. G. Martishchenko 1968 12 p refs In RUSSIAN
(VNIIRT-1) Avail: AEC Depository Libraries

The X-ray fluorescence determination of low concentrations of iron in oil and analyses of powdered copper ore concentrates using a bremsstrahlung $^3H/Zr$ source are described. Proportional counters and X-ray sources were used for measuring the wear of aviation, marine, and automobile engines. Sensitivities of the method for copper and iron are given. NSA

N69-34871# California Univ., Berkeley. Lawrence Radiation Lab.
MOESSBAUER RESONANCE STUDIES OF GOLD COMPOUNDS
Marjorie Omori Faltens (Ph.D. Thesis) Feb. 1969 203 p refs
(Contract W-7405-ENG-48)
(UCRL-18706; PB-183571) Avail: CFSTI CSCL 07D

Mossbauer experiments were performed at liquid helium temperature on linear gold (I) compounds and square-planar gold (III) compounds. A linear relationship was established between the isomer shift and quadrupole splitting values for both the aurous and auric compounds. These results are explained in terms of the comparable electric field gradient values of the 6d and 6p electrons of gold and the differences in the ionic character of the compounds. A scale was established to indicate the number of 6s electrons on gold which corresponds to a given isomer shift and the number of 6p electrons and 5d electron holes which are responsible for the observed quadrupole splittings. Author (USGRDR)

N69-34873# Bureau of Mines, Amarillo, Tex. Helium Research Center.
COMPRESSIBILITY DATA FOR HELIUM AT 0 DEG C AND PRESSURES TO 800 ATMOSPHERES

Tedford C. Briggs, B. J. Dalton, and Robert E. Barieau Aug. 1969 58 p refs
(BM-RI-7287) Avail: Issuing Activity

The thermodynamic properties of helium and helium-containing mixtures were reviewed and evaluated. Twenty-two compressibility runs were made with helium at 0° C and pressures to 800 atmospheres using a Burnett-type apparatus. Data from the 22 runs were treated simultaneously and as separate runs while different functional forms and weighting factors were used. A fourth-degree-polynomial equation in the pressure gives a statistically satisfactory representation of the compressibility factor when the data are treated simultaneously and a weighting factor of $P_r^{-3/4}$ is used. The second virial coefficient of helium at 0° C from this investigation is 11.997 ±0.015 cm^3 $mole^{-1}$. The stated uncertainty is the random error standard deviation. Compressibility factors determined by this investigation are precise to better than 0.01 percent and are believed to be accurate to better than 0.02 percent. Author

N69-34876# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
ELECTRICAL RESISTIVITY OF HYPERSTOICHIOMETRIC COLUMBIUM AND ZIRCONIUM CARBIDE MATERIALS AT ELEVATED TEMPERATURES
Danton L. Paulson and Gene Asai Aug. 1969 34 p refs
(BM-RI-7289) Avail: Issuing Activity

Elevated temperature electrical resistivity measurements were made on arc-melted, spin-cast, and hot-pressed columbium carbide-carbon and zirconium carbide-carbon materials up to 2600° C. The CbC-C material displayed electrical resistivity values ranging from 35.20 microhm cm at 23° C for hot-pressed material containing 12 wt pct carbon to 242.64 microhm cm at 1622° C for arc-cast material containing 17.0 wt pct carbon. Electrical resistivity values ranged from 29 microhm cm at 20° C for arc-cast ZrC-C containing 16 wt pct carbon to 279 microhm cm at 1951° C hot pressed ZrC-C containing 21 wt pct carbon. Data from a previous report were included to establish comparison between the electrical resistivities of the columbium carbide-carbon, zirconium carbide-carbon, and hafnium carbide-carbon systems. Author

N69-34882# Eidgenossische Technische Hochschule, Zurich (Switzerland).
ON THE OXIDATION OF LOW ALCOHOLS ON SILICA GEL CATALYSTS [UEBER DIE OXYDATION VON NIEDRIGEN ALKOHOLEN AN SILICAGELKATALYSATOREN]
Peter Ruesch (Ph.D. Thesis) 1968 115 p refs In GERMAN *Its* Diss. No. 3966
Avail: CFSTI

Principles of the gas catalysis on solid catalysts are reviewed, with emphasis on the chemisorption in heterogeneous catalytic processes. The use of physical adsorption for determining the microstructure of catalysts is discussed. The relationship between microstructure, chemisorption, and catalytic effectiveness was experimentally studied in the oxidation of methanol, ethanol, and propanol on silica gel catalysts. Hydrothermal aging was used to produce catalysts of identical chemical structure but with different microstructures. These catalysts were then examined for specific surface, pore size, and proportional content of silanol groups. The chemisorption of alcohol on silica gel, in addition to physical adsorption was experimentally proven. The effectiveness of silica gel as catalyst for the oxidation of alcohols to the corresponding carbonic acids and aldehydes was investigated, including reaction rate and microstructure effects. Aldehydes and carbonic acids were found to be the result of parallel reactions, while carbon oxides resulting from the oxidation were formed by thermal dissociation of the primary products. Trans. by K.W.

N69-34895# California Univ., Berkeley. Lawrence Radiation Lab.
DIFFUSION AND MIGRATION IN ELECTROCHEMICAL SYSTEMS
Limin Hsueh (Ph.D. Thesis) Dec. 1968 197 p refs
(Contract W-7405-ENG-48)
(UCRL-18597; PB-183568) Avail: CFSTI CSCL 07D

The limiting current and concentration profile in a stagnant diffusion cell are calculated for a concentrated copper sulfate solution with consideration of the variation of physical properties and nonzero interfacial velocity. The calculated concentration profile is compared with that observed optically in a cell with a stagnant electrolyte at the limiting current. The possibility and the method for obtaining differential diffusion coefficients from the limiting current measurements are explored. The effect of migration on the limiting current and the concentration difference between bulk and surface are measured and compared with calculated value from the incomplete dissociation of bisulfate ions. Author (USGRDR)

N69-34914*# State Univ. of New York, Stony Brook. Coll. of Engineering.
THERMODYNAMIC PROPERTIES OF INTERSTITIAL ELEMENTS IN THE REFRACTORY METALS Semiannual Report, 1 Dec. 1968 - 31 May 1969
D. K. Gupta, S. C. Srivastava, and L. Seigle 31 May 1969 17 p refs
(Grant NGR-33-015-035)
(NASA-CR-104092; SAR-6) Avail: CFSTI CSCL 07D

Experimental methods for determination of the activity of carbon in the refractory metals are reviewed and analyzed. The activity of C in Mo and W may be determined by several techniques, among which determination of the calcium vapor pressure over mixtures of Me, Me_2 C, and Ca C_2 appears most promising. Measurement of the CO pressure over mixtures of Me + C, and Me O offers a possibility for determining the activity of C in Nb and Ta at high temperatures. Author

N69-34919# Colorado Univ., Boulder.
A CONSTANT PRESSURE GAS ABSORPTION REACTOR
M. B. Kennedy and J. R. Lacher 1968 7 p
(Grant NSF-GP-5408)
(PB-183396) Avail: CFSTI CSCL 07D

A gas absorption reactor is described and can be used to study the rate of uptake of gases for gas-liquid reactions occurring at constant pressure in the temperature range of 20 to 30C. This reactor can also be used for gas solubility studies by determining the volume of gas absorbed per unit volume of liquid at atmospheric pressure. The apparatus includes the following features: simple techniques for charging liquid sample holder and introducing liquid to reaction bulb; a modification which permits air-sensitive liquids to be used; and a sampling device which can be used to withdraw liquid or gas samples from the reaction flask. Author (USGRDR)

N69-34975# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
PREPARING ALKALIZED ALUMINA
Laurance L. Oden and Paul E. Francoeur Sep. 1969 20 p refs
(BM-RI-7294) Avail: Issuing Activity

Three processes for preparing $NaAl(OH)_2CO_3$, the intermediate compound which is calcined to produce alkalized alumina were studied: (1) mixing of Na_2CO_3 and of $Al_2(SO_4)_3$ solutions, (2) digestion of aluminum hydroxide in solutions of Na_2CO_3 and $NaHCO_3$ at 90° C, and (3) addition of CO_2 at 25° C to caustic solutions of aluminum to precipitate aluminum hydroxide followed by digestion at 90° C. The first process had the highest raw

material consumption and washing requirements, and successful application of process 2 depended upon the availability of active aluminum hydroxide. Process 3 was the most effective, considering both process technology and raw material requirements. Procedures were also investigated for washing, filtering, drying, and calcining precipitates. Analytical methods included X-ray diffraction, atomic absorption spectroscopy, differential thermal analysis, and thermogravimetric analysis. Author

N69-34982# California Univ., Berkeley. Lawrence Radiation Lab.

THE MICROWAVE SPECTRUM AND RING PUCKERING OF 1, 1-DIFLUOROCYCLOPENTANE, PART 1. COMPUTERS AS INTERACTIVE DEVICES IN CHEMICAL EXPERIMENTS, PART 2

Richard Millikan (Ph.D. Thesis) Nov. 1968 72 p refs
(Contract W-7405-ENG-48)
(PB-183476; UCRL-18821) Avail: CFSTI CSCL 07D

The microwave spectrum of 1,1 difluorocyclopentane has been studied in detail. The rotational spectra for the lowest ten vibrational states have been assigned. Microwave-microwave double resonance techniques have been used extensively in the assignment of two of these states. An analysis of the vibration-rotation interaction present in the spectra has yielded a determination of the potential energy surface governing the out-of-plane motions of the ring-skeletal atoms. The molecule was found to be stably bent with a barrier to pseudorotation of 280 plus or minus 20/cm. An interface between a Varian A-60 NMR spectrometer and a small digital computer is described. A number of general aspects of the use of computers as interactive elements in chemical experiments are discussed with relation to this experience. Author (USGRDR)

N69-34984# Iowa State Univ. of Science and Technology, Ames. Ames Lab.

THORIUM–THORIUM TETRACHLORIDE SYSTEM

John Edward Fuller (M.S. Thesis) Nov. 1968 58 p refs
(Contract W-7405-ENG-82)
(IS-T-301) Avail: CFSTI

A study was made of the Th–$ThCl_4$ system. Existence of a high temperature allotrope of $ThCl_4$ was confirmed and x ray powder data were obtained for this phase. The liquidus of the system was determined using a liquid solubility equilibration technique. Effects of oxygen on $ThCl_4$ were evaluated and tentative modifications of the previously reported Th_2–$ThCl_4$ phase diagram were made on this basis. Several attempts to prepare any lower chlorides of thorium were not successful. Author (NSA)

N69-35010# Iowa State Univ. of Science and Technology, Ames. Ames Lab.

TRANSPORT REACTIONS OF THORIUM OXYDIIODIDE

Douglas Guy Adolphson (M.S. Thesis) Feb. 1969 29 p refs
(Contract W-7405-eng-82)
(IS-T-302) Avail: CFSTI

Traces of a remarkably voluminous red product corresponding to the composition of $ThOI_2$ were found in the cooler ends of the tantalum container in an earlier study of the synthesis and properties of thorium diiodide. Since that time, white $ThOI_2$ was prepared and some of its properties described, but no mention of the red modification or the migration of the compound from hotter to cooler zones was made. White $ThOI_2$ was obtained by the direct reaction of ThO_2 and ThI_4 in either tantalum or fused silica apparatus. The transport reaction $ThOI_2(s) + 2HI(g) = ThI_4(g) + H_2O(g)$ was established as the cause of the migraion of the compound to cooler zones. The red modification was obtained when white $ThOI_2$ was heated in the presence of thorium metal in tantalum apparatus. While the means of coloration is not completely obvious, the evidence suggests that a stoichiometric excess of thorium may be responsible. Author (NSA)

N69-35013# British Petroleum Co., Ltd., Sunbury-on-Thames (England). Research Center.

CALORIC VALUE STANDARDS IN THE UK GAS INDUSTRY

G. J. F. Reid 12 May 1968 4 p refs
(TM-110-184) Avail:

Described are definitions of the units of heat and the standard reference conditions for gas volume measurement. This report is designed to give the differences in gas industry measurements and those of Great Britain. Measurements were taken for gas conditions, units of heat, and calorific values. Results indicate the definitions of both the gas industry and Great Britian are on the same order with only .056 difference. E.H.W.

N69-35020# Technische Hochschule Munchen (West Germany). Institut fuer Radiochemie.

INVESTIGATION OF INTER AND INTRAMOLECULAR ENERGY TRANSFER IN ALKANEBENZENE MIXTURES AND ALKYLBENZENES

H. Heusinger, A. Zeman, and H. Hofer Jan. 1969 47 p refs
In GERMAN; ENGLISH summary
(BMwF-FBK-69-2) Avail: CFSTI

From investigations of radiolytic hydrogen production and radical formation in alkane-benzene mixtures, n-alkylbenzenes, and isomeric alkylbenzenes conclusions on energy transfer processes can be drawn. A Markov chain approach shows, that energy transfer from the aliphatic component to the phenyl ring for alkane-benzene mixtures is 10 times, for alkylbenzenes 13 times more probable than dissociation of a C-H bond or deactivation of the states involved. These results suggest, that in alkylbenzenes besides intermolecular energy transfer also intramolecular energy transfer takes place. Scavenger experiments give some information on the mechanism. Author (NSA)

N69-35026# Iowa Univ., Iowa City. Dept. of Chemistry.

MASS SPECTROMETRIC DETERMINATION OF DISSOCIATION ENERGIES OF PRASEODYMIUM SULFIDE, GADOLINIUM SULFIDE, AND PRASEODYMIUM OXIDE

James A. Fries and E. David Cater 3 Apr. 1969 43 p refs
(Contract AT(11-1)-1182)
(COO-1182-27) Avail: CFSTI

The dissociation energies of the gaseous molecules PrS, GdS, and PrO were determined by means of isomolecular equilibrium studies, using as reference values $D^0_0(YS) = 125.7 \pm 3.0$ and $D^0_0(YO) = 171.8 \pm 4.0$ kcal/mole. Ames et al. (J. Phys. Chem. 71: 2707(1967)) previously determined the dissociation energy of PrO, and a comparison of results was made in an attempt to arrive at a "best" value. A mass spectrometric study of GdS and an earlier study of Pr_3S_4 also allow calculation of the gaseous dissociation energies of GdS and PrS. Results of these various studies are described, and best values of the dissociation energies are reported. Author (NSA)

N69-35037# Brookhaven National Lab., Upton, N.Y.

ABNORMAL BUBBLE MOVEMENT AND INDUCED "ROLL CELL" FORMATION IN FLUIDIZED BEDS

John T. Sears Jun. 1968 10 p refs
(BNL-50142) Avail: CFSTI

In constrast to the normal pattern of downward motion of particles adjacent to the wall, a roll cell of particles was visually observed through a glass column in an aggregatively-fluidized bed.

Due to the effect of a nonuniform magnetic field, a mixture of iron and glass particles rose on one side of a column and returned on the other. Apparently bubble motion can be influenced by the particles themselves, and an induced lateral movement of the rising bubbles causes this change in the particle motion patterns. Author (NSA)

N69-35038# Roswell Memorial Park Inst., Buffalo, N.Y. Dept. of Biophysics

MAGNETIC RESONANCE STUDIES OF THE OXIDATION AND REDUCTION OF ORGANIC MOLECULES BY IONIZING RADIATIONS

Harold C. Box, Harold G. Freund, Kenneth T. Lilga, and Edwin F. Budzinski [1968] 76 p refs
(Contract AT(30-1)-3558; Grant PHS-G-RH-00450)
(TID-25057) Avail: CFSTI

By maintaining organic compounds at low temperature (4.2°K) it is often possible to stabilize oxidation and reduction products produced by ionizing radiation. The products were observed by electron spin resonance (ESR) and in some cases by electron nuclear double resonance (ENDOR) spectroscopy. The oxidized and reduced species observed in irradiated single crystals of thiourea derivatives, several organic disulfides, thiodiglycolic acid, glycine, glycine-HCl, and two dicarboxylic acids are enumerated. Some G-values for ion production at 4.2°K are also given. The results are discussed in terms of the following processes: electron attachment, dissociative electron attachment, intramolecular transfer of holes, and anion degradation. Author (NSA)

N69-35039# United Kingdom Atomic Energy Authority, Harwell (England). Chemistry Div.

SOME CHEMICAL METHODS FOR THE SEPARATION OF HIGH PURITY SHORT-LIVED FISSION PRODUCTS

R. J. Bullock and N. R. Large Mar. 1969 13 p refs
(AERE-M-2135) Avail: CFSTI; HMSO: 2s 6d

Standard radiochemical techniques were adapted to give rapid separation of radiochemically pure samples of short-lived isotopes of the following elements: bromine, rubidium, silver, cesium, lanthanum, and praseodymium. Three of the elements considered, silver, lanthanum, and praseodymium, are obtained by milking their precursors, palladium, barium, and cerium. Author (NSA)

N69-35068# Chicago Univ., James Franck Inst.

MICROSCOPIC THEORY OF FORCE CONSTANTS IN SOLIDS

Morrel H. Cohen, Richard M. Martin, and Robert M. Pick 1969 35 p refs
(NONR-2121(22))
(AD-688478) AVAIL: CFSTI CSCL 7/4

The expression of the force constants are derived from the energy of a neutral system of interacting nuclei and electrons. These force constants depend only on the nuclear charges and the inverse dielectric function of the electronic system. It is verified that they fulfill the general symmetry, translational and rotational invariance properties required by the Born-Van Karman theory. When the role of the core electrons is neglected, those force constants can be evaluated in metals from the bare ionic potentials. In insulators, the existence of long wave length acoustical phonons implies that the inverse dielectric function satisfies a certain number of sum rules. The method becomes more difficult to apply, which explains the general use of phenomenological models. Author (TAB)

N69-35078# Rensselaer Polytechnic Inst., Troy, N.Y.

RADIATION CHEMISTRY OF GASES Final Report

P. Harteck and S. Dondes May 1969 19 p refs
(Contract AT(30-3)-321)
(RPI-321-19) Avail: CFSTI

The results of studies on the radiolysis of CO_2 and N_2-O_2 are briefly discussed. NO_2 was found to be an effective inhibitor in the decomposition of CO_2. The G-value for the CO_2 decomposition in the presence of NO_2 approached 10. NO_2 was only weakly decomposed into N_2 and O_2 and N_2O was also formed. In a search for more intense radiation sources, the possibility of using the impact of the fission recoil particles as a source of ionizing radiation in reactor experiments was investigated. An exceedingly intense radiation source was developed by using ^{235}U in the form of the oxide in contact with the gases to be studied, and the system was inserted into the nuclear reactor. Author (NSA)

N69-35079# Central Electricity Generating Board, Bristol (England). Nuclear Labs.

THE RADIOLYSIS OF METHANE ADSORBED ON PGA GRAPHITE AND COCONUT SHELL CHARCOAL

D. A. Dominey and T. Swan Mar. 1969 12 p refs
(RD/B/N-1311) Avail: CFSTI/UK

The radiolysis of methane adsorbed on P.G.A. graphite and coconut shell charcoal was investigated at a number of surface coverages. No evidence was found for the sensitization of the radiolysis by transfer of energy from the solid to the adsorbed gas. Author (NSA)

N69-35080# Dow Chemical Co., Golden, Colo. Rocky Flats Div.

RADIATION CHEMISTRY OF NITRIC ACID SOLUTIONS

Frend J. Miner, Armen R. Kazanjian, Alan K. Brown, Paul G. Hagan, and James W. Berry 7 Jan. 1969 12 p refs
(Contract AT(29-1)-1106)
(RFP-1299) Avail: CFSTI

Nitric acid solutions of varying concentrations were γ, α, and β irradiated. Solutions that were α or β irradiated were analyzed for nitrite only; solutions that were γ irradiated were irradiated under a variety of conditions and analyzed for all stable products. The results showed that the nitrite yields for γ and β irradiation were essentially the same. The yields increased with increasing HNO_3 concentration up to about 1 M, but then decreased. The nitrite yields from α irradiation were appreciably lower than the yields from γ and β irradiations at lower acid concentrations, but continually increased with increasing HNO_3 concentration. A possible mechanism, based on linear-energy-transfer (LET) effects is proposed. The effects of oxygen, acid concentration, and temperature on the nitrite yield from γ irradiation were also studied. Hydrogen peroxide yields and gaseous products were also determined for γ irradiation, the latter by mass spectrometry. Author (NSA)

N69-35087# Technische Hochschule Munchen (West Germany).

ESR-INVESTIGATIONS AND MO MODEL CALCULATIONS FOR DETERMINING SPIN DENSITY DISTRIBUTION IN SUBSTITUTED NAPHTHALENE ANION RADICALS [ESR INVESTIGATIONS AND MO MODEL CALCULATIONS ZUR BESTIMMUNG DER SPINDICHTEVERTEILUNG IN SUBSTITUIERTEN NAPHTHALIN-ANIONEN-RADIKALEN]

Rainer Muecke (Ph.D. Thesis) 1969 22 p refs In GERMAN
Avail: CFSTI

Experimental spectral data are compared with the results of model calculations according to the Huckel-LCAO theory, including the approximated configuration interchange effect according

to McLachlan. Coulomb and resonance integral parameters as well as the processes for determining the nitrogen dissociations of nitro and nitrile groups were obtained from the literature, where they were used for the anions of analog benzene derivatives. The results of the model calculations serve as a basis for a qualitative discussion of structural and steric particulars of individual radical anions and for the applicability of the parametric statements that were used. Transl. by K.W.

N69-35148# National Bureau of Standards, Washington, D.C. Electrochemical Analysis Section.
ELECTROCHEMICAL ANALYSIS SECTION: SUMMARY OF ACTIVITIES, JULY 1968–JUNE 1969
Roger G. Bates, ed. Aug. 1969 100 p
(NBS-TR-503) Avail: SOD $1.00

Brief summaries of several lines of work under way are given. The concept of a broad program on acidity measurements is outlined, and new efforts to provide assistance in clinical acid-base measurements are summarized. Progress toward reference standards for the calibration of ion-selective electrodes is reported. Equilibrium data for phosphoric acid in heavy water, for piperazinium ion in 50 wt % methanol-water, and for hydrochloric acid in a solvent composed of 2-methoxyethanol (80 wt %) and water (20 wt %) have been obtained. Considerable effort has been devoted to the development of new standard reference materials, including standards for conductivity measurements. Lists of publications, talks, and committee assignments of staff members are given. Author

N69-35189# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
HIGH-TEMPERATURE MASS SPECTROMETRY. VOLUME 1: FREE VAPORIZATION STUDIES OF GRAPHITES
F. M. Wachi and D. E. Gilmartin 27 Jan. 1969 47 p refs
(Contract F04701-68-C-0200)
(AD-687439; TR-0200(4250-40)-6-Vol-1; SAMSO-TR-69-124-Vol-1) Avail: CFSTI CSCL 7/4

Some of the differences in the published data on the free vaporization of conventional (ATJ, ZTA, UT-6) and pyrolytic graphites were resolved. Relative abundances, relative rates of vaporization, and activation energies of vaporization have been measured for carbon species C1 through C5, for conventional graphites in the temperature range 2800 - 3000K, and for pyrolytic graphite in the temperature range 2600 - 3000K. Differences in the free evaporation behavior of the two types of graphites are discussed. Plausible vaporization mechanisms are presented that account for the time dependency of species distribution at constant surface temperature for conventional graphites, and for the differences in activation energies of vaporization for C4 and C5 molecules vaporizing from pyrolytic and conventional graphites. The effects of the differential rates of carbon evaporation from the crystalline and binder phases on the free vaporization behavior of conventional graphites at temperatures greater than about 2950K are described. Author (TAB)

N69-35267# Rocky Flats Div., Dow Chemical Co., Golden, Colo.
VACUUM ACCELERATED-ION DEPOSITION
Robert G. Kurtz and T. Van Vorous 17 Apr. 1969 8 p refs
(Contract AT(29-1)-1106)
(RFP-1295) Avail: CFSTI

A new evaporation technique was investigated which utilizes the thermal energy of a resistance source to ionize, either directly or indirectly, an evaporant metal placed in the source. The ionized evaporant is accelerated towards a substrate by placing a high negative potential on the substrate. Not all metals exhibit this ability to be ionized. Of twenty-two metals investigated, only nine showed measurable current during evaporation. Author (NSA)

N69-35277# McGill Univ., Montreal (Quebec).
QUANTUM MECHANICS TUNNELING AS A VISCOELASTIC RELAXATION
Adi Eisenberg and Shimon Reich 1 Jun. 1969 16 p refs Submitted for publication
(Contract N00014-68-C-0237)
(AD-688361; TR-21) Avail: CFSTI CSCL 11/9

It is proposed that quantum mechanical tunneling may be the viscoelastic relaxation mechanism for methyl group containing polymers at low temperatures. This proposal is based on the agreement of the tan sigma peaks at given frequencies with the tunneling frequencies for methyl groups of reasonable barrier heights at corresponding temperatures. The proposed mechanism, in conjunction with published frequency-barrier height correlations, allows the estimation of the barrier heights for a wide range of methyl groups from the knowledge of a single tan delta maximum. The barriers are in general agreement with those obtained by NMR techniques for similar materials. Author (TAB)

N69-35278# Naval Ammunition Depot, Crane, Ind.
THE EFFECT OF THE PARTICLE SIZE OF SODIUM NITRATE ON THE PERFORMANCE OF FLARE COMPOSITIONS
Sydney L. Howlett 1 Apr. 1969 32 p refs
(AD-688423; NAD-CR-RDTR-139) Avail: CFSTI CSCL 19/1

The particle size of sodium nitrate is shown to have a significant effect upon the performance of illuminating flare composition. Possible mechanisms of the propagation of a flame front through a pressed pyrotechnic composition are proposed. Author (TAB)

N69-35282# Naval Ammunition Depot, Crane, Ind.
HANDBOOK OF SELECTED PROPERTIES OF AIR AND WATER-REACTIVE MATERIALS Final Report, Jan. 1966–Dec. 1968
Jack R. Gibson and Jeanne D. Weber Mar. 1969 225 p refs
(AD-688422; NAD-CR-RDTR-144) Avail: CFSTI CSCL 7/4

The Handbook of Selected Properties of Air-Reactive and Water-Reactive Materials represents the work resulting from the literature search covering the years 1950 through 1968. Data are presented on the following properties of the pertinent compounds molecular weight, melting point, characteristics, boiling point, vapor pressure, synthesis, solubility, thermodynamic properties and flammability. In addition, attention is paid to other characteristics such as toxicity, handling and military and industrial uses. The material is arranged in three parts: Inorganic Compounds; Organic Compounds; and Miscellaneous Compounds (analyzing complex compounds, mixtures and byproducts of chemical reactions). Author (TAB)

N69-35289# European Space Research Inst., Frascati (Italy).
ABSORPTION SPECTRUM OF RbI IN THE VACUUM ULTRA-VIOLET
J. P. Connerade Apr. 1969 20 p refs Submitted for publication
Sponsored by London Univ. and Sci. Res. Council
Avail: CFSTI

A new investigation of the absorption spectrum of Rb vapor in the region 600–900 Å has yielded considerable extension of Beutler's early results (1934) and the analysis has been revised. The transitions are listed in terms of a generalized (J_cK) coupling notation. Some calculations concerning the RbII spectrum have also been made. Many of the RbI features observed exhibit large autoionization Author (ESRO)

N69-35325# Clarkson Coll. of Technology, Potsdam, N.Y.
SURFACE AND INTERFACIAL STUDIES OF ICE AND INTERACTION OF WATER AND POLYMERIC MATERIALS AT TEMPERATURES BELOW 0 DEG C. ADSORPTION OF WATER VAPOR ON POLYMERS AND FREEZING OF AQUEOUS POLYMER SOLUTIONS WITH REFERENCE TO CRYOBIOLOGY Final Report, Mar. 1966 – Jul. 1968
H. H. G. Jellinek Mar. 1969 9 p refs
(Contract Nonr-5053(02))
(AD-688473) Avail: CFSTI CSCL 11/9

A study was initiated on freezing of Polyvinylpyrrolidone aqueous solutions as a function of polymer concentration and temperature. This resulted in a publication entitled: Freezing of Aqueous Polyvinylpyrrolidone Solutions. Degradation of aqueous polyvinylpyrrolidone by freezing was investigated: Degradation of Polymers in Solution by Freezing. Also adsorption isotherms of water/polymer systems were studied: Isosteric heats and entropies of adsorption were evaluated: Sorbed Water on Polymers Near 0C. Research with the object of clarifying the mechanism of protection of blood cells by freezing in presence of polyvinylpyrrolidone were also carried out (see previous reports). Author (TAB)

N69-35326# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ARSENAZO 3: METHODS OF PHOTOMETRIC DETERMINATION OF ACTINIDE ELEMENTS
S. B. Savvin Dec. 1968 177 p refs Transl. into ENGLISH of the book "Arsenazo 3 (Methody Fotometricheskogo Opredeleniya Redkikh i Aktinidnykh Elementov" Moscow, 1966 p 1–256
(AD-687624; FTD-HT-23-67-68) Avail: CFSTI CSCL 7/4

The book discusses the theoretical and practical aspects of the use of the reagent arsenazo III and some of its analogs for the determination of thorium, uranium, zirconium, hafnium, scandium, cerium, lanthanum, rare earth elements, plutonium, neptunium, curium, protactinium, niobium, barium, strontium and sulfur. The first part of the book considers the mechanism of complexing and color reactions, the composition and structure of the complexes, the selectivity and other general properties of reagents of the arsenazo-thoron group. The second, practical part of the book gives complete descriptions of methods for determining the series of rare and actinide elements with arsenazo III and its analogs in various substances, and indicates the selectivity, sensitivity, photometry conditions and other data. Most of the techniques have been worked out for the analysis of specific materials, but with some modifications (decomposition of the material, choice of the most efficient methods of separating impurities for a given case, etc.), they can be used as guidelines for determining elements in other materials as well. Author (TAB)

N69-35345# Maine Univ., Orono.
EFFECTS OF RADIATION OF ALKALI AZIDES USING ELECTRON SPIN RESONANCE TECHNIQUES Final Report
Douglas W. Wylie 31 Mar. 1969 8 p
(Contract AT(30-1)-3681)
(NYO-3681-3) Avail: CFSTI

A description is given of the ESR X-band superheterodyne spectrometer and its operation. RbN_3 single crystals were irradiated with X-rays, ultraviolet rays, and gamma rays at 77°K and their ESR spectra examined before and after warming to 300°K. The results indicate that the paramagnetic center NO is formed by X irradiation and N^-_4 is formed by μv irradiation; no ESR spectra resulted from the gamma irradiation. The structure of NaN_3 is discussed. NSA

N69-35351# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.
GAMMA-RADIOLYSIS OF LIQUID CARBON MONOXIDE AT MINUS 196 DEG C
H. W. Buschmann et al 1968 19 p refs Transl. into ENGLISH from Z. Naturforsch. (Tubingen), v. 22a, 1967 p 954–960
(AERE-Trans-1107) Avail: CFSTI; HMSO: 3s

The radiation chemistry of liquid carbon monoxide at −196°C and mixtures of CO with various gases was investigated. In the γ radiolysis of pure CO, CO_2 was formed with $G(CO_2) = 0.18$. The addition of CH_4, C_2H_4, O_2, and NO led to the formation of C_3O_2 which was not observed in the γ radiolysis of pure CO. In the case of $CO–CH_4$ mixtures the following products were identified: C_2H_6, C_2H_2, H_2CO, H_2C_2O (Ketene), CO_2, and C_3O_2. Results of experiments with $CO–CH_4–{}^{13}CH_4$ and $CO–CH_4–CD_4$ mixtures and measurements of the dependence of $G(CO_2)$, $G(C_3O_2)$, $G(C_2H_2)$, and $G(C_2H_6)$ on the concentration of CH_4 showed that ethane is formed by energy transfer from CO to CH_4 or by reaction of CH_4 with excited CO and that C_3O_2 and C_2H_2 are formed by reaction of free carbon atoms which are formed in the presence of methane. Author (NSA)

N69-35379*# Israel Program for Scientific Translations, Ltd., Jerusalem.
RATE THERMAL IONIZATION OF NITROGEN AT 3000–5000 K
T. V. Bazhenova and Yu. S. Lobastov *In its* High-Temp. Properties of Gases. Phys. Gas Dyn., Thermodyn. and Phys. of Combust. 1969 p 108–111 refs (See N69-35385 20-12)
Copyright. Avail: CFSTI CSCL 07D

The time taken for an equilibrium degree of ionization to be established in nitrogen at 3000–5000°K was determined from the absorption by nitrogen of centimeter radio waves behind a shock wave in a square 7×7 cm^2 shock tube. The velocity of the incident shock was was measured by means of two piezoelectric pressure-sensitive elements on an oscillograph. Control measurements of the velocity of the reflected shock and the structure of the gas column behind it were obtained in some of the experiments with the aid of an optical shadow instrument and a drum photometer. The accuracy of the velocity measurement was 1%. The microradio-wave absorption was measured in a special plexiglass section, from the end of which the shock wave was reflected. The determination of the free-electron concentration and the effective collision frequency from the above measurements was described in detail. Experimental data indicated that the ionization time of nitrogen for T = 4000°K was an order of magnitude higher than the ionization time of air and agreed with calculated values. Author

N69-35393*# Israel Program for Scientific Translations, Ltd., Jerusalem.
FRONT NATURE OF THE REACTION SURFACE WITH THE MEDIUM
V. M. Eroshenko, A. V. Morar, and Yu. N. Terentiev *In its* High-Temp. Properties of Gases. Phys. Gas Dyn., Thermodyn. and Phys. of Combust. 1969 p 183–195 refs (See N69-35385 20-12)
Copyright. Avail: CFSTI CSCL 07D

The physical model of an isothermal surface front is used to analyze heat propagation in chemically reacting media. Excluding the equilibrium state, all natural phenomena are included in this front by propagation and smoothing. The motion of such surfaces is represented by parabolic partial differential equations. Experimental studies of the sublimation of naphthalene spherical models for air speeds between 50 and 270 m/sec, Mach number M = 1.7, and stream stagnation temperatures between 80 and 150°C showed that the surface displacement followed the laws of motion of a wave front, such as Huyghen's principle. G.G

N69-35394*# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE SUBLIMATION OF SOLIDS IN A SUPERSONIC STREAM
V. M. Eroshenko and Yu. N. Terentiev *In its* High-Temp. Properties of Gases. Phys. Gas Dyn., Thermodyn. and Phys. of Combust. 1969 p 196–204 refs (See N69-35365 20-12)
Copyright. Avail: CFSTI CSCL 07D

Wind tunnel studies on the sublimation rate of naphthalene spheres in a supersonic stream are reported. Schlieren photographs of model shapes and dimensions at different stages of evaporation were used to determine the coordinates of the model contours at stagnation temperatures of 20° to 85°C. It was found that the front surface of the mode sphere conserved its spherical shape with its initial radius up to very extensive evaporation. Sometimes the leading stagnation point reached 70% to 85% of the value of the initial radius without any change in the curvature of the model surface. Experimental results agreed with conclusions drawn from a theoretical model of surface front motion of an evaporating material. G.G.

N69-35395*# Israel Program for Scientific Translations, Ltd., Jerusalem.
A METHOD FOR VISUALIZING ISOTHERMAL SURFACES
Yu. N. Vorontsov, V. M. Eroshenko, A. V. Moror, and Yu. N. Terentiev *In its* High-Temp. Properties of Gases. Phys. Gas Dyn., Thermodyn. and Phys. of Combust. 1969 p 205–208 refs (See N69-35365 20-12)
Copyright. Avail: CFSTI CSCL 07D

Supersonic wind tunnel tests were performed on polytetrafluorethylene spheres in order to observe the successive stages of motion of their recrystallization fronts during aerodynamic heating. The relationship between the velocity of motion of the heat front and the gradual translucence of the model materials was photographically recorded, as well as the time interval at which the entire model became translucent. Results showed that the radius of the curvature of the isothermal surface of the translucent front remained constant until the velocity of motion of the leading point in the front began to deviate from linear values. Above 900°K recrystallization was independent of stream stagnation temperature. G.G.

N69-35408# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
ISOTOPE EXCHANGE BETWEEN HYDROGEN AND AMINES CATALYZED BY ALKALI ALKYLAMIDES [ECHANGE ISOTOPIQUE ENTRE L'HYDROGENE ET LES AMINES CATALYSE PAR LES ALCOYLAMIDURES ALCALINS]
Elisabeth Rochard Jun. 1969 46 p refs In FRENCH; ENGLISH summary
(CEA-R-3835) Avail: CFSTI

The kinetics of the isotope exchange between hydrogen and monomethyl-, isopropyl-, and dimethyl-amine catalyzed by their corresponding amides have been investigated. The rates of exchange have been measured at three temperatures for catalyst concentrations up to 10^2 mole l^{-1}; they are in the following sequence: $v_{(DMA)} > v_{(MMA)} > v_{(IPA)}$. The activation energies were found to have almost the same values: $Ea_{(MMA)} = 6.8 \pm 0.5$ Kcal · mole $^{-1}$, $Ea_{(IPA)} = 6.5 \pm 1$ Kcal · mole $^{-1}$; $Ea_{(DMA)} = 7.0 \pm 0.5$k Kcal · mole $^{-1}$ Author (ESRO)

N69-35472# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
CHRONOPOTENTIOMETRY IN MOLTEN CHLORIDES: APPLICATION TO THE STUDY OF THE ELECTROCHEMICAL PROPERTIES OF URANIUM AND PLUTONIUM IN THE LiCl/KCl EUTECTIC [CHRONOPOTENTIOMETRIE DANS LES CHLORURES FONDUS: APPLICATION A L'ETUDE DES PROPRIETES ELECTROCHIMIQUES DE L'URANIUM ET DU PLUTONIUM DANS L'EUTECTIQUE LiCl/KCl]
André Leseur (Ph.D. Thesis–Conservatoire Natl. Arts et Métiers) May 1969 95 p refs In FRENCH; ENGLISH summary
(CEA-R-3793) Avail: CFSTI

Using solutions of cadmium chloride in the eutectic LiCl/KCl, a chronopotentiometric method has been developed with a view to its application to the study of molten solutions. Particular attention has been paid to the choice of the indicator electrodes. The method makes it possible to analyze molten solutions quantitatively and to determine diffusion coefficients and their activation energies; it also yields information about the nature and the behavior of ionic species in solution. The method has been applied to the study of solutions of uranium and plutonium chloride in the eutectic LiCl/KCl. Linear chronoamperometry has been used for studying these solutions qualitatively, but chronopotentiometry, for which the theory is better developed, is best for a quantitative study. The results obtained have made it possible to determine the diffusion coefficients of the ions Cd^{2+}, U^{3+}, U^{4+} and U (IV) in the presence of F^- and Pu^{3+} ions, as well as the activation energy of these diffusion coefficients. Author (ESRO)

N69-35499*# Techtran Corp., Glen Burnie, Md.
SYNTHESIS OF PHOSPHOROUS HOMO- AND MIXED AROMATIC POLYIMIDES [SINTEZ FOSFORSODERZHASHCHIKH GOMO- I SMESHANNYKH AROMATICHESKIKH POLIMIDOV]
G. S. Kolesnikov et al Washington NASA Sep. 1969 5 p refs Transl. into ENGLISH from Vysokomolekul. Soedin (Moscow), Ser. B, v. 10, no. 10, 1968 p 781–783
(Contract NASw-1695)
(NASA-TT-F-12569) Avail: CFSTI CSCL 07C

The conditions of synthesis are studied and also the relationship between the properties of the polyimides and their structure and composition. Phosphorus-containing homo- and mixed polyimides were synthesized. The structure of the polymers obtained was verified by data of IR-spectroscopy. It was established that the phosphorus-containing polyimides obtained are characterized by high solubility. Author

N69-35517# Princeton Univ., N.J. Frick Chemical Lab.
ENERGY TRANSIENTS IN HARMONIC OSCILLATOR SYSTEMS
Arthur V. Tobolsky, Irving L. Hopkins (Bell Telephone, Murry Hill, N.J.), and Edward T. Samulski
(Contract N00014-67-A-0151)
(AD-688451; TR-117; ONR-TR-RLT-117) Avail: CFSTI CSCL 7/4

The approach to energy equilibration is discussed for a system of N isolated classical oscillators, coupled or uncoupled. Exact solutions can be given for the kinetic and potential energies versus time, for a simple boundary condition which distributes the potential energy equally between all the normal modes at zero time and which gives zero kinetic energy to all the normal mode oscillators at zero time. Most solutions are ergodic but a special class is nonergodic, i.e., the potential energy versus time shows exact recursions. The half-life for approaching the equilibrium value of potential or kinetic energy is of the order of the reciprocal maximum frequency of the oscillators. The fluctuations from equilibrium are treated by an extension of the method of Rayleighs problem of random walks. The results are of interest in connection with the ergodic theorem of statistical mechanics. Author (TAB)

N69-35538*# Autonetics, Anaheim, Calif.
INVESTIGATION OF SINGLE CRYSTAL FERRITE THIN FILM Semiannual Report, 1 Feb. – 31 Jul. 1969
P. J. Besser, J. E. Mee, and E. C. Whitcomb 31 Jul. 1969 28 p refs
(Contract NAS12-522)
(NASA-CR-86203) Avail: CFSTI CSCL 07D

The deposition effort was devoted to experiments utilizing $FeCl_3$ in place of $FeCl_2$ with the goal of achieving an improved match to the reactivity of the LiI. Considerable difficulty was encountered in achieving and maintaining reproducible $FeCl_3$ reactivity and transport rates. Evaluation of the best deposits obtained with this material indicated that a reactivity imbalance still remained. Consequently the decision was made to return to $FeCl_2$ as the iron source material. Analysis of previous deposits made with $FeCl_2$ has provided additional insight into the mechanisms responsible for low magnetization, conductivity, optical absorption and ferromagnetic relaxation in the films. Comparison of the relevant material properties shows that good quality epitaxial $LiFe_5O_8$ on MgO or $MgAl_2O_4$ has definite advantages over $Y_3Fe_5O_{12}$ on $Gd_3Ga_5O_{12}$ in the launch and propagation of surface and volume acoustic waves. The realization of these advantages requires the achievement of resonance linewidths comparable to the best bulk values. Author

N69-35563# California Univ., Livermore. Lawrence Radiation Lab.
HEPTAVALENT NEPTUNIUM AND PLUTONIUM [SEMIVALENTNYYE NEPTUNYI I PLUTONIY]
M. P. Mefodeva Apr. 1969 9 p ref Transl. into ENGLISH from Priroda (Moscow), no. 10, 1968 p 70 – 72 Supported by AEC
(UCRL-Trans-10343) Avail: CFSTI

The production of Np(VII) by passing a rapid stream of ozone through a 2 to 3M basic solution of Np(VI) as indicated by spectral changes including formation of bands at 410 and 625 nm was reported previously. Similar experiments produced a new band 635 nm when Pu was oxidized by the same means from Pu(IV) to Pu(III). Neptunium(VI) was found to be oxidized by persulfate, periodate, XeO_3, perxenate, hypochlorite, hypobromite, and Na bismuthate, as well as electrochemically. The new valence states have strong oxidizing properties. NSA

N69-35573# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
DIFFUSION OF CALCIUM IN PURE AND DOPED NaCl [DIFFUSION DU CALCIUM DANS LE CHLORURE DE SODIUM PUR ET DOPE]
Lawrence Slifkin and Gilbert Brebec Apr. 1969 14 p refs In FRENCH; ENGLISH summary
(CEA-R-3769) Avail: CFSTI

Ca^{++} diffusion measurements in pure NaCl or NaCl doped with $CaCl_2$ led to the determination of the activation energy of the Ca^{++} migration and the binding energy between calcium ions and vacancies. Author (ESRO)

N69-35610# National Inst. of Radiological Sciences, Chiba (Japan).
CHEMISTRY
In its Radiol. Sci. Oct. 1968 p 11 – 18 refs (See N69-35606 20-04)
Avail: AEC Depository Libraries

Research progress is reported on: adsorption of cesium on copper ferrocyanide and potassium copper ferrocyanide, adsorption of radiostrontium on calcium phosphate anion exchange resin, autoxidation of 2-ethoxyindole and 2-ethylthioindoles, NMR spectra of oxindoles and 2-indolinethiones, transquanylation of AET and APT, Schiff base formation from pyridoxal in methanol, volatility of ^{210}Po in airborne dusts, preparation of mevalomic-3', 4-D and 3', 4-T acid, and a permix burner with heated mixing chamber in atomic absorption spectrophotometry. Author (NSA)

N69-35628*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
INVESTIGATIONS OF CHEMICAL REACTIONS TO SOLID BODY SURFACES WITH EXOELECTRONS AFTER X-RAY EXPOSURE PART 1: DISSOCIATION REACTION [UNTERSUCHUNGEN CHEMISCHER REAKTIONEN AN FESTKOERPEROBERFLAECHEN MIT EXOELEKTRONEN NACH ROENTGENBESTRAHLUNG. 1:DISSOZIATIONSREAKTIONEN]
J. Kramer Washington NASA Aug. 1969 17 p refs Transl. into ENGLISH from Z. Physik. Chem. (Frankfurt), v. 25, no. 1-6, 1960 p 289 – 309
(Contract NASw-1692)
(NASA-TT-F-12483) Avail: CFSTI CSCL 07D

A method for surface investigations on solid bodies is described, which is based on the emission of exoelectrons after X-ray irradiation. To begin with, the physical principles of this phenomenon are presented and the necessary apparatus is described. In the present study, the method is then applied to the investigation of thermal dissociations. Author

N69-35648# Scientific Translation Service, Ann Arbor, Mich.
DETECTION OF WELD DEFECTS OPENING ONTO THE SURFACE THROUGH USE OF AMMONIA GAS
N. Chretien, J. F. Chretien, and P. Cortley [1969] 24 p refs Transl. into ENGLISH from the French Presented at the 12th Metallurgy Colloq., Saclay, France, 24 Jun. 1968 Prepared for Oak Ridge Natl. Lab.
(ORNL-TR-1936; CEA-CONF-1074) Avail: CFSTI

A method, based on ammonia sweating, has been perfected for the detection of surface defects in welds. The process consists of three operations: first the container surrounding the zone to be tested is evacuated; then this container is placed under ammonia pressure; and finally, after a return to atmospheric pressure, a reactive paint is applied to the specimen. Very clear patches then appear on the points showing where defects emerge at the surface, such as flaws, cracks, pores, etc. Author (NSA)

N69-35656*# Stanford Research Inst., Menlo Park, Calif.
RESEARCH RELATED TO MEASUREMENTS OF ATOMIC SPECIES IN THE EARTH'S UPPER ATMOSPHERE
Bernard J. Wood 1968 29 p refs
(Contract NASr-49(30); SRI Proj. 6682)
(NASA-CR-105429; QSR-7) Avail: CFSTI CSCL 07D

The interactions of oxygen with silver and platinum were studied with a quadrupole mass analyzer. Measurements were made and are presented in graphs of the atom loss coefficient, and sorption and desorption rates of oxygen atoms on silver. It is felt that the results may be of value in interpreting oxygen concentration data of the Explorer 32 mass spectrometer. The reaction coefficient and total mass of oxygen sorbed and subsequently desorbed on a flash-cleaned platinum surface were also determined. A mechanism of the oxygen--platinum interaction is proposed. It is considered that the results indicate that oxygen is competitive with carbon monoxide for sorption sites and that the reaction coefficient of oxygen on platinum is high. N.E.N.

N69-35722*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

THERMAL DECOMPOSITION OF ALKALI METAL CHLORATES [TERMICHESKOYE RAZLOZHENIYE KHLORATOV SHCHELOCHNYKH METALLOV]

A. A. Shiolovskiy Washington NASA Aug. 1969 7 p refs Transl. into ENGLISH from Issled. Obl. Khim. Tekhnol. Miner. Solei. Okislov., Akad. Nauk SSSR, SB. Statei (USSR), 1965 p 108–112 (Contract NASw-1692)

(NASA-TT-F-12476) Avail: CFSTI CSCL 07D

The authors investigate the thermal stability of alkali metal chlorates by the thermogravimetric method. It is shown that the order in which the chlorates under investigation decompose remains the same when a catalytic admixture of 5% manganese dioxide or cobalt chloride is added within a certain temperature range. When the quantity of the catalyst is increased, the speed of thermal decomposition of the chlorates increases at first, but this increase lessens within the range from 3 to 10% (the representative curves are of a parabolic nature). Author

N69-35724# California Univ., Livermore. Lawrence Radiation Lab.

HYDROGENATION OF NATURAL AND SYNTHETIC CIS-1, 4-POLYISOPRENE [GIDROGENIZATSIA PRIRODNOGO I SINTETICHESKOGO TSIS-1,4-POLIIZOPRENA]

A. I. Yakubchik et al Jan. 1969 10 p refs Transl. into ENGLISH from Vestn. Leningr. Univ., Ser. Fiz. i Khim. (Leningrad), V. 16 no. 22, 1961 p 136–138

(PB-183164; UCRL-Trans-10320) Avail: CFSTI CSCL 07C

Presented is a study on the influence exerted by various conditions on the degree of hydrogenation of natural cis-1,4- folyisoprene obtained from latex, and of synthetic unbranched cis- 1,4 -polyisoprene. We also determined some properties of hydrogenated polyisoprenes with various degrees of residual unsaturation. Author (USGRDR)

N69-35728# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France).

ELECTROCHEMICAL PROPERTIES OF URANIUM, CERIUM AND ZIRCONIUM IN THE LITHIUM FLUORIDE–BARIUM FLUORIDE EUTECTIC [PROPRIETES ELECTROCHIMIQUES DE L'URANIUM, DU CERIUM ET DU ZIRCONIUM DANS L'EUTECTIQUE FLUORURE DE LITHIUM–FLUORURE DE BARYUM]

René Cartier (Ph.D. Thesis–Conservatoire Natl. Arts et Métiers), May 1969 59 p refs In FRENCH; ENGLISH summary

(CEA-R-3792) Avail: CFSTI

An attempt has been made to carry out an electrochemical analysis of the ions U^{4+}, Ce^{3+}, Zr^{4+} in a fluoride melt, and to obtain some of the electrochemical properties of these ions. It was first necessary to develop a method for purifying the LiF/BaF_2 eutectic in order to be able to make electrochemical studies using linear chronoamperometry and chronopotentiometry. The polarization curves recorded in solutions for the ions U^{4+}/U^{3+}, show that the systems Ce^{3+}/Ce^{4+} and Zr^{4+}/Zr are rapid. After checking that mass transport on the electrode is controlled by diffusion, the diffusion coefficients for the ions Ce^{3+}, U^{4+} and Zr^{4+} were determined. The oxidizing nature of the ion Ce^{4+} makes it possible to dissolve ceric oxide in the molten fluoride. The existence of two zirconium oxyfluorides was demonstrated; they appear after dissolution of the zirconia in a solution of zirconium tetrafluoride. These results are of interest in the preparation of metals by electrolytic reduction of their oxides. Author (ESRO)

N69-35740# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.

PRODUCTION OF ULTRA-HIGH VACUUM OF HYDROCARBONS

H. Hoch 1968 6 p Transl. into ENGLISH from Vakuum-Tech. (Berlin), v. 16, no. 7, 1967 p 156–158

(AERE-Trans-1108) Avail: CFSTI; HMSO: 1s 9d

By means of a sputter-ion pump and a titanium evaporator pump ultrahigh vacuum was produced in a 15 litre container. The fore vacuum was produced either by a combination of oil diffusion pump and mechanical pump or by a mechanical pump only. Between these pumps and the container liquid nitrogen cooled traps were fitted. First ultimate pressures in the 10^{-9} torr range were produced without baking. After baking up to 400°C the ultimate pressures obtained were 1.7×10^{-11} torr and lower. After a short-time airing of the apparatus or flooding with dry nitrogen gas and re-evacuating, ultimate pressures of several 10^{-11} torr were obtained without further baking. Only after airing for a period of several days no better ultimate pressures than about 10^{-9} torr were obtainable. During the pumping procedure and at ultimate pressure the gas contents were analyzed by means of an Omegatron. The relevant spectra are reproduced in this study. Author (NSA)

N69-35741*# Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.

DEVELOP METHODS FOR PREPARATION OF PURE COPPER (2) FLUORIDE AND DEVELOP ANALYTICAL TECHNIQUES FOR DETERMINATION OF IMPURITIES Final Report

J. R. Lundquist 12 Jun. 1969 25 p refs

(Contract NAS3-10942)

(NASA-CR-72571) Avail: CFSTI CSCL 07B

This report describes the following methods for the preparation of ultra pure copper (II) fluoride: (1) fluorination of copper (II) hydroxyfluoride; (2) decomposition of a copper (II) ammonium fluoride double salt; and (3) fluorination of copper (II) sulfide. Method 1 was used to prepare one kilogram of ultra pure copper (II) fluoride. Analytical techniques used to assure product purity are described. Author

N69-35750# Los Alamos Scientific Lab., N. Mex.

A CONTRIBUTION TO THE STUDY OF THE Pu–Zr PHASE DIAGRAM

J. C. Lauthier et al 1 Apr. 1969 15 p refs Transl. into ENGLISH from J. Nucl. Mater. (Amsterdam), v. 23, 1967 p 313–319

(LA-tr-69-2) Avail: CFSTI

The intermetallic compound $PuZr_2$ can be synthesized from the elements only in the presence of oxygen, which considerably accelerates diffusion. At 615°C a peritectoid reaction takes place. Author (NSA)

N69-35755*# California Univ., Berkeley. Lawrence Radiation Lab.

ORGANIC GEOCHEMISTRY

William Van Hoeven (Ph.D. Thesis) Jan. 1969 248 p refs (Grant NGL-05-003-003; Contract W-7405-eng-48)

(NASA-CR-105396; UCRL-18690) Avail: CFSTI CSCL 06A

This thesis attempts to place organic geochemical research on the origin of life into its proper context, both historically and scientifically. The basic assumptions on which this research rests are critically examined, the concept of biological markers and chemical fossils are discussed in detail. Each of the four major classes of biochemicals, carbohydrates, proteins and peptides, nucleic acids, and lipids are analyzed as to the suitability, either of individual compounds or of conglomerations within a compound type, for use as chemical fossils. Structural specificity, biosynthetic relatability, possible abiotic synthesis and thermal stability are the main points discussed. Experimental resulst relevant to the origin of life problem is included. Author

N69-35759# European Space Research Inst., Frascati (Italy).
ABSORPTION SPECTRUM OF Cs I IN THE VACUUM ULTRA-VIOLET
J.-P. Connerade (Imp. Coll. of Sci. and Technol.) May 1969 23 p refs Submitted for publication Sponsored by Roy. Soc. and Sci. Res. Council
Avail: CFSTI

A new investigation of the absorption spectrum of Cs vapor in the 600 to 900 Å region has resulted in revisions and extensions of Beutler and Guggenheimer's early work (1934). In particular, a prominent series has been observed. Transitions are listed in (J_cK) notations, using a new analysis of terms from the Cs II spectrum. A comparison between the Rb I and Cs I spectra is made, and two types of two-electron excitation in inner shell absorption spectra are distinguished. Many features of the Cs I spectrum exhibit very large autoionization widths. Author (ESRO)

N69-35766*# National Bureau of Standards, Washington, D.C.
A SURVEY OF THERMODYNAMIC PROPERTIES OF THE COMPOUNDS OF THE ELEMENTS CHNOPS Progress Report, 1 Jan. – 30 Jun. 1969
George T. Armstrong and Eugene S. Domalski 28 Jul. 1969 46 p refs
(NASA Order W-12-758; NBS Proj. 316-11-0429)
(NASA-CR-105268) NBS-10-070) Avail: CFSTI CSCL 07D

Selected values for the heats of combustion and formation at 298°K for the following classes of organic compounds are reported: aliphatic hydrocarbons, alicyclic hydrocarbons, aromatic hydrocarbons, aliphatic alcohols, phenols, aliphatic di- and polyols, aldehydes, ketones, n-aliphatic acids, hydroxy aliphatic acids, and unsaturated aliphatic acids. The total number of compounds for which selected values have been made in this report is 115. Author

N69-35770# Northwestern Univ., Evanston, Ill.
THE RADIATION CHEMISTRY OF HIGH POLYMERS Technical Report, 1 Apr. 1968–1 Apr. 1969
Malcolm Dole 1 May 1969 10 p refs
(Contract AT(11-1)-1088)
(COO-10833; TR-14) Avail: CFSTI

Research was conducted in the following areas: (1) An investigation was made of the combined use of ultraviolet, infrared absorption, and EPR spectra in studying the kinetics of free radical reactions in irradiated polymers, principally polyethylene. (2) G-values were determined for the production of the alkyl, allyl, and dienyl free radicals during and subsequent to irradiations at liquid nitrogen temperature and their UV and IR extinction coefficients were also determined. (3) The Kinetics were studied of the conversion of alkyl to allyl free radicals in solid polyethylene at room and higher temperatures, both uncatalyzed and catalyzed by molecular hydorgen, and activation energies for the uncatalyzed and catalyzed reactions were determined. (4) Studies were conducted on the radiation chemistry of molten polyethylene, polypropylene oxide, polymethylene oxide. Author

N69-35784# Junta de Energia Nuclear, Madrid (Spain). Div. of Chemistry and Isotopes.
SPECTROSCOPIC ANALYSIS BY EMISSION SPECTRA FOR MANGANESE TRACE CONTAMINANTS IN IRON OXIDES [DETERMINACION ESPECTROGRAFICA CUANTITATIVA DE TRAZAS DE MANGANESO EN OXIDO FERRICO]
C. Capdevila and M. Roca 1968 15 p refs In SPANISH; ENGLISH summary
(JEN-202-DQ/I-69) Avail: CFSTI

In order to enhance the sensitivity, different electrode types and sweeping substances have been studied. Graphite anodes, with 5 × 2.5, 4 × 4.5, 4 × 8 and 7 × 10 mm crater, as well as CuF_2, AgCl, ZnO and graphite powder as sweeping materials, have been tested. A JACO-Ebert grating spectrograph and 10 A. d.c. arc have been employed, choosing the proper exposure times from moving-plate studies. Using 4 × 4.5 mm electrodes and 75% AgCl a detection limit of 0.2 ppm is attainable. Author (ESRO)

N69-35803# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.
POTENTIOMETRIC MEASUREMENTS IN FUSED SALTS: THE PRINCIPLE AND THE CONSTRUCTION OF AN OXYGEN ELECTRODE HAVING A ThYO SOLID ELECTROLYTE MEMBRANE WHICH CONDUCTS OXIDE IONS
B. Eichler et al Apr. 1968 7 p refs Transl. into ENGLISH from Z. Physik. Chem. (Frankfurt), v. 236, no. 5/6, 1967 p 372–377
(AERE-Trans-1110) Avail: CFSTI; HMSO: 1s 9d

An oxygen electrode was constructed using a ThO_2 ceramic tube, sealed at one end. The ceramic tube was prepared by the dross casting method and was sintered gas-tight at 2150°C. In order to avoid contamination of the ceramic, the initial material was pulverized in a polyethylene vessel. The reproducibility of the potential measurements was tested using the Ag/AgCl reference electrode, in the potentiometric titration of Na_2O with $Na_4P_2O_7$. The results showed the reproducibility of the electrode potential improved with increasing temperature. NSA

N69-35809*# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
INVESTIGATION OF RARE EARTH IONS: SPECTROSCOPIC RELAXATION PROCESSES OF RARE EARTH IONS IN CRYSTALS Final Report, 1 Mar. – 31 Jul. 1969
H. Warren Moos 31 Jul. 1969 40 p refs Presented at the Intern. Conf. Luminescence, Aug. 1969
(Grant NGR-21-001-002)
(NASA-CR-105406) Avail: CFSTI CSCL 07D

The primary goal of the program was to broaden existing knowledge of rare earth ions in crystals since little was known about the interaction of the ion with the phonons in the crystal, the transfer of excitation from one energy level to another, the effects of charge compensation when ions of one valence are doped into a crystal site of a different valence, the interaction of the ions with each other, etc. The early fluorescence lifetime studies have been extended. We now know that rare earth ions relax from one level to another with the emission of several phonons. Further, the relaxation rate depends critically on the number of phonons emitted and it is now possible to predict whether a level will relax or fluoresce. The attached paper reviews the status of work of this type, most of which has been done here. Author

N69-35822# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
CONTRIBUTION TO THE STUDY OF FLUORINE RELAXATION IN NON-MAGNETIC HEXAFLUORIDES [CONTRIBUTION A L'ETUDE DE LA RELAXATION DES FLUORS DANS LES HEXAFLUORURES NON MAGNETIQUES]
Paul Rigny (Ph.D. Thesis–Paris Univ., 13 Dec. 1967) May 1969 80 p refs In FRENCH; ENGLISH summary
(CEA-R-3464) Avail: CFSTI

The interesting properties of the fluorine magnetic resonance in the hexafluorides of molybdenum, tungsten and uranium, are very much due to large anisotropies of the chemical shift tensors. In the solid phases these anisotropies, the values of which are deduced from line shape studies, show that the molecules undergo hindered rotations about the metal atom. The temperature and

frequency dependence of the fluorine longitudinal relaxation times shows that the relaxation is due to the molecular motion. The dynamical parameters of this motion are then deduced from the complete study of the fluorine relaxation in the rotating frame. In the liquid phases, the existence of anisotropies allows an estimation of the different contributions to the relaxation. In particular, the frequency and temperature dependence of the relaxation shows it to be dominated by the spin-rotation interaction. It is shown that the strength of this interaction can be deduced from the chemical shifts, and the angle through which the molecule rotates quasi-freely can be determined. In the hexafluorides, this angle is roughly one radian at 70°C, and with the help of this value, the friction coefficients which describe the intermolecular interactions are discussed. Author (ESRO)

N69-35880# Commissariat a l'Energie Atomique, Saclay (France). Department des Radioelements.

PILOT INSTALLATION FOR THE SEPARATION OF CAESIUM 137 BY CENTRIFUGATION [INSTALLATION PILOTE DE SEPARATION DU CAESIUM 137 PAR CENTRIFUGATION]

J. Fradin 1969 126 p refs In FRENCH; ENGLISH summary
(Contract EURATOM-025-62-10 RISF)
(EUR-4236.f) Avail: CFSTI

This pilot installation was set up in order to establish the industrial value of the chemical process developed in the laboratory and tested up to now on a static apparatus which is not suitable for an installation intended for continuous operation. Using the pilot unit it was possible to carry out complete chemical processing cycles which can be extrapolated to a large apparatus. Technological information was obtained on the value both of the chemical apparatus and on that of the control. This report gives a description of the shielded cells and the mechanical and chemical apparatus with all the protective and safety devices as well as the measurement, operation, adjustment and control procedures. Author

N69-35885# Los Alamos Scientific Lab., N.Mex.

DERIVATION OF ALLOY ACTIVITY EQUATIONS FOR EMF CELLS INVOLVING DISPLACEMENT REACTIONS

Donald R. Conant 15 Nov. 1968 10 p refs
(Contract W-7405-eng-36)
(LA-4102) Avail: CFSTI

Equations were derived for relating cadmium activity to emf measurements obtained from cells of the type: W – Cd | Cd. CdX_2 ‖ Cd. CdX_2, M_1 | Cd. M_1 – W $a_{cd} = 1$ $a_{cd} < 1$, where M_1 represents a metal that displaces a significant amount of cadmium in molten halide electrolyte forming ions with a single unit positive charge. Results from the thermodynamics of irreversible processes are used in the development of these equations because of the irreversible flow of cadmium and of M^{+}_{1} ions present in this type of cell. The final equation is very complex, but, for very dilute alloys, reduces to a more simple form. Equations were also derived that relate emf to M_1X concentration for cells. For dilute solutions with M_1X, it is assumed they follow Raoult's limiting law. Author (NSA)

N69-35874# Southwest Research Inst., San Antonio, Tex.

DEVELOPMENT OF BATTERY SEPARATOR MATERIAL PROCESS Quarterly Report

L. M. Adams and W. W. Harlowe, Jr. 11 Jul. 1969 34 p Prepared for JPL
(Contracts NAS7-100; JPL-951718; SwRI-Proj. 01-2015)
(NASA-CR-105280) Avail: CFSTI CSCL 07D

The poly(acrylic acid) content of acrylic acid-grafted polyethylene film is proportional to the acrylic acid content of the grafting solution used to graft the polyethylene film. The electrical resistance of the grafted film decreases as the poly (acrylic acid) content of the grafted film increases. The electrical resistance also decreased when the temperature is increased in the neutralizing and rinsing bath. However, the higher temperature may be detrimental to the product as the silver ion migration increases when the neutralizing and rinsing temperature is increased. Methacrylic acid-grafted polyethylene film has low electrical resistance, high tensile strength, and high elongation. This material decreases in length from the dry dimension when sterilized in 40 percent potassium hydroxide. Properties of battery separator material prepared in large quantities are presented. Author

N69-35875 Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

N.M.R. STUDY OF ORGANO-PHOSPHORUS COMPOUNDS: NON-EQUIVALENCE OF METHYLENIC PROTONS IN THE α POSITION OF AN ASYMMETRIC PHOSPHORUS ATOM: APPLICATION TO STUDY OF COUPLING CONSTANTS J SUB P , SUB H AND J SUB H, SUB H [R.M.N. DE COMPOSES ORGANO-PHOSPHORES. NON EQUIVALENCE DE PROTONS METHYLENIQUES EN α D'UN PHOSPHORE ASYMETRIQUE: APPLICATION A L'ETUDE DES CONSTANTES DE COUPLAGE J SUB P, SUB H, ET J SUB H, SUB H]

Jean-Pierre Albrand May 1969 103 p refs In FRENCH; ENGLISH summary
(CEA-R-3733) Avail: CFSTI

Non-equivalent methylenic protons, with respect to an asymmetric center, have been observed in the n.m.r. spectra of some three- and tetra-coordinated phosphorus compounds. The analysis of these spectra yield the following results: a) in the studied secondary phosphines, the inversion rate at the phosphorus atom is slow on the n.m.r. time scale; b) the geminal coupling constant, for a free-rotating methylene group attached to a phosphorus atom, is negative; c) in phosphines the non-equivalence of methylenic protons reveals two $^{2}J_{P\text{-}C\text{-}H}$ coupling constants which differ by about 5 Hz. This result is in agreement with previous studies on cyclic phosphines. In phosphine oxides, the $^{2}J_{P\text{-}C\text{-}H}$ values are negative. The $^{3}J_{H\text{-}P\text{-}C\text{-}H}$ coupling constant is positive in both phosphines and phosphine oxides. In phosphines, the non-equivalent methylenic protons exhibit two nearly equal values for this coupling constant. Author (ESRO)

N69-35878# Los Alamos Scientific Lab., N.Mex.

A CONTRIBUTION TO THE STUDY OF THE PLUTONIUM-THORIUM SYSTEM

A. Y. Portnoff and D. Calais [1969] 16 p refs Transl. into ENGLISH from J. Nucl. Master. (Amsterdam), no. 24, 1967 p 158–163
(LA-tr-69-5) Avail: CFSTI

The plutonium–thorium phase diagram was studied by metallography, dilatometry, thermal analysis and x rays. The following transformations were established: a peritectic transformation at 595°C ± 6°C, liquid (Th, Pu) + β (Th, Pu) ⇌ ξ, where ξ is a compound of well-defined composition Pu7 Th3, as determined by microanalysis (the density is 15.5 g/cm3, which is inconsistent with the formulas and densities quoted by Poole (Pu13 Th6, d = 14 g/cm3) and by Bochvar (Pu16 Th3, d = 14.5 g/cm3); and a eutectoid transformation at 582°C, β (Th, Pu) ⇌ α (Th, Pu) + ξ at a plutonium content of 49 ± 3 at. %, which is in contradiction with Poole's results but in rough agreement with Bochvar, who quotes 35 at % Pu at 600°C. Author (NSA)

N69-35883# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A METHOD OF PREPARING PERFLUORETHYL-BETA-DIETHLYAMINOVINYLKETONE
I. L. Knunyants et al Nov. 1968 5 p Transl. into ENGLISH from Russian Patent No. 203868 (Appl. No. 1109982/23-4, 26 Oct. 1966) 2 p
(AD-688684; FTD-HT-23-1064-68) Avail: CFSTI CSCL 7/4

The title compound (1-diethylamino-4-5-pentafluoro penten-3-one) is prepared by treating triethylamine with perfluoropropylene oxide. Author (TAB)

N69-35885*# California Univ., Berkeley. Sea Water Conversion Lab.
STUDY OF PERMEABILITY CHARACTERISTICS OF MEMBRANES Quarterly Report, 9 Feb. – 9 May 1969
K. S. Spiegler, J. C. T. Kwak, D. A. Zelman, and J. Leibovitz 9 May 1969 11 p Prepared for JPL
(Contracts NAS7-100; JPL-952109)
(NASA-CR-105281; QR-6) Avail: CFSTI CSCL 07D

Some volume flow measurements across the AMF C-103 cation-exchange membrane under the influence of osmotic and pressure forces are reported. The effect of small volume losses from the cell compartments on the osmosis and hyperfiltration experiments is evaluated. An experimental procedure was worked out to correct for the leak rate, even in experiments where osmotic flow is taking place. Some improvements in the switching mechanism of the concentration feedback system and new conductivity cells are described. Author

N69-35888# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.
THE STRUCTURE OF LIQUID WATER [LA STRUCTURE DE L'EAU LIQUIDE]
Bernard Marin May 1969 32 p refs In FRENCH; ENGLISH summary
(CEA-R-3775) Avail: CFSTI

A very complete review and bibliography on the structure of liquid water is presented. As it is impossible, at present, to synthesize all the water structure models only the main physical properties have been considered. New hypotheses on the electronic structure of water molecules, the hydrogen bond, spectroscopic studies, relaxation processes, dielectric constant, temperature effects, and partition and thermodynamic functions are all considered. Author (ESRO)

N69-35901# Joint Publications Research Service, Washington, D.C.
INORGANIC POLYMERS
J. Van Wazer 13 Aug. 1969 23 p refs Transl. into ENGLISH from Usp. Khim. (Moscow), v. 38, no. 6, 1969 p 1108–1124
(JPRS-48612) Avail: CFSTI

A general discussion of the chemistry of inorganic polymers is presented, including tabulated classification of inorganic oligomers and polymers by structure and examples of high molecular compounds whose structure has been clearly established. A substance is defined as inorganic if at least half of the atoms in the basic chain are not carbon. Several characteristic signs distinguishing inorganic, high molecular compounds from organic polymers are discussed and subdivided into two categories. These categories are:(1) identification by participation in the chemical binding of the lower orbits; and (2) identification by establishing the equilibrium of the molecular structures. A.C.R.

N69-35945# Joint Publications Research Service, Washington, D.C.
GAS CHROMATOGRAPHY USED TO STUDY AIR POLLUTION
S. F. Yavorovskaya 19 Aug. 1969 6 p Transl. into ENGLISH from the book "Gigiyena Truda i Professionalnyye Zabolevaniya" Moscow, no. 1, 1969 p 42–45
(JPRS-48644) Avail: CFSTI

The use of gas chromatography for analyzing air pollution is considered, a chromatographic device is described. The highly sensitive ionization detectors make detection of toxic substances possible in the air on the order of one thousandth of a milligram per liter. An accumulation of test substance is required for the study of lower concentrations. It is concluded that gas chromatography is an indispensable method of research in air hygiene due to its simultaneous qualitative, and quantitative determinations, rapidity, high sensitivity and lower cost. F.O.S.

07 COMMUNICATIONS

Includes communications equipment and techniques; noise radio and communications blackout; modulation telemetry tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N69-34758# Army Aeromedical Research Unit, Fort Rucker, Ala.
PHILOSOPHIES OF VOICE COMMUNICATION SYSTEMS DESIGN
Robert T. Camp, Jr. *In* AGARD Pattern Recognition, Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 4 p (See N69-34751 20-04)
Avail: CFSTI

A new philosophy of communication systems design is proposed. Data from recent experiments support the argument that the realization of improved voice communication systems will depend largely upon a change of philosophy. Tape recordings of new experienced system are presented as evidence that is possible to have high intelligibility under high ambient noise conditions. A basis for changing criteria for accepted speech intelligibility is presented. Author

N69-34886# Sandia Corp., Albuquerque, N. Mex. Signal Processing and Analysis Div.
A GENERALIZED RADAR-RETURN COMPUTATIONAL TECHNIQUE
J. A. Cooper Jan. 1969 70 p refs Revised
(SC-TM-67-3006A; PB-183118) Avail: CFSTI CSCL 17I

The report discusses many of the radar-return problems confronting radar designers, including antenna pattern measurement, polarization properties, target modeling and scattering cross section per unit area. A computational technique is developed, allowing the practical application of experimental measurements in a programmed solution that is unusually general. Author (USGRDR)

N69-34888# Sandia Corp., Albuquerque, N.Mex.
AN INTERIM SIX-CHANNEL PREDETECTION COMBINER SYSTEM
T. W. Caffey, J. B. Noe, and W. R. Hale Nov. 1968 33 p
(SC-DR-68-706; PB-183455) Avail: CFSTI CSCL 09F

The operation and performance of six-channel predetection combiner system, using standard receivers, which was developed as part of the conversion from P band to S band telemetry frequencies are described. Author (USGRDR)

N69-34903*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE FEASIBILITY OF WIRELESS POWER TRANSMISSION FOR AN ORBITING ASTRONOMICAL STATION
William Robinson 27 May 1969 62 p refs Revised
(NASA-TM-X-53806) Avail: CFSTI CSCL 17B

An examination is made of the feasibility of using microwave or laser energy for wireless transfer of power from a manned, earth-orbiting central station to unmanned astronomical substations. This is a recent conception, and details of a power-transfer system have not been established. Therefore, the possibility of wireless power transfer is judged on the basis of the state of research and development in power generation, transmission, and conversion. Author

N69-34934# National Bureau of Standards, Boulder, Colo. Inst. for Basic Standards.
RADIO-FREQUENCY MEASUREMENTS IN THE NBS INSTITUTE FOR BASIC STANDARDS
Robert S. Powers, ed. and William F. Snyder, ed Jun. 1969 43 p refs
(NBS-TN-373) Avail: SOD $1.00

A collection of diagrams, tables, and text material is presented which has been assembled to show the interrelationships between various radio frequency measurements made by the Institute for Basic Standards (IBS). In particular, the measurements are those which lead to services provided to the public or to other government agencies. These services include not only calibrations made for fees, but the broadcast services of the four NBS radio stations. Measurements made as part of the IBS research and development program are not included. The information included is designed to give the users and potential users of the radio frequency services a clearer understanding of the origins of the measurement output of IBS in this field. Author

N69-34976# Forsvarets Forskningsanstalt, Stockholm (Sweden).
THERMAL IMAGING DEVICE FOR MEASURING INTENSITY DISTRIBUTION IN ALIGNED HORN ANTENNAS [VAERMEBILDSTELEVISION SOM HJAELPMEDEL VID MAETNING AV ETT LINSFOERSETT ANTENN-HORNS INTENSITETSFOEDELNING]
Staffan Quensel Nov. 1967 10 p refs In SWEDISH
(FOA-2-C-2199-52) Avail: CFSTI

The intensity distribution in the main lobe of a microwave emitted from a horn lens antenna was measured by placing a flat plate of a microwave-absorbing material in the focal plane near the aligned antenna. The heat generated by the microwave in the plate is representative of the intensity distribution. A television thermal detector was used to sense the heat. Oscillograms and photographs are used for evaluating the distribution. Transl. by K.W.

N69-34994# Weather Bureau, Silver Spring, Md. Equipment Development Lab.
VIDEO INTEGRATOR AND PROCESSOR
Kenneth H. Shreeve Feb. 1969 34 p refs
(WBTM-EDL-8; PB-183510) Avail: CFSTI CSCL 17I

The report describes the design and operation of a new weather radar intensity contouring device. The device accepts raw video information, and averages these data both in range and in the direction of scan to obtain improved estimates of the mean echo intensity. The average video signal is then level sensed and encoded to produce a radar display with seven categories of precipitation intensity. Author (USGRDR)

N69-35003# Naval Research Lab., Washington, D. C. Radar Div.
MEDIAN DETECTOR FOR NONCOHERENT DISTRIBUTIONS
G. V. Trunk 9 May 1969 21 p refs
(AD-688416; NRL-6898) Avail: CFSTI CSCL 17/9

Sea-clutter measurements using high-resolution radar indicate that clutter cross-section returns do not follow a Rayleigh distribution. The log-normal and contaminated-normal distributions have been suggested, and detection curves for these distributions have been published. In this report, the median detector is proposed as a detector against these clutter distributions, and the theory is developed which is necessary for detecting constant signals in log-normal and contaminated-normal clutter when one has N independent samples. Curves are obtained for the threshold values and probabilities of detection for false-alarm probabilities ranging from 10 to the -2 power to 10 to the -9 power. If one compares the mean and median detectors, the conclusion is reached that the median is better for the log-normal distribution and that the mean is slightly better for the contaminated-normal distribution for small sample sizes. Using the concept of asymptotic relative efficiency, the median is shown to be better than the mean for large sample sizes for both distributions. Author (TAB)

N69-35126# Communication Satellite Corp., Washington, D. C.
THE ADVANTAGES OF DEMAND ASSIGNMENT FOR INTERNATIONAL SATELLITE COMMUNICATION SYSTEMS
W. L. Pritchard and J. G. Puente [1969] 26 p refs Presented at the 9th Brit. Interplanet. Soc. European Space Symp., London, 14–16 May 1969 Sponsored by Intern. Commun. Satellite Consortium
Avail: CFSTI

Methods of accessing a satellite and assigning satellite channels between earth terminal are discussed with special emphasis on techniques of demand assignment along with its technical and economic advantages. ESRO

N69-35255*# Auburn Univ., Ala. Microwave Research Lab.
MILLIMETER WAVES STUDY. RADIO FREQUENCY SYSTEM Quarterly Report, 1 Sept. – 1 Dec. 1968
1 Dec. 1968 41 p refs
(Contract NAS8-11184)
(NASA-CR-61885; QR-19) Avail: CFSTI CSCL 17B

In the millimeter wave study, efforts were directed toward the definition of the satellite-earth transmission channel at K_a-band. Attention focused on amplitude variations, limitations, and distortions due to ionospheric and tropospheric attenuation, refractive effects, and fading. In the work on the radio frequency systems, progress is described in the construction and testing of a 2250-MHz prototype television exciter unit. Completion of the transmitter case and mounting and interconnecting of the circuit modules is discussed. A dc-to-dc converter was constructed and tested. Filter networks were designed which are located between the converter outputs and the individual transmitter circuits. The frequency stability of a reference oscillator was analyzed, and work on a transmitter instruction manual and construction documentation is described. K.W.

N69-35257# Forsvarets Forskningsanstalt, Stockholm (Sweden).
A METHOD FOR CALCULATING A RADAR TARGET AREA [EN METOD FOER RADARMALAREABERAEKNINGAR]
H. Steyskal, Jr. Oct. 1967 70 p refs In SWEDISH
(FOA-3-A-3698-61) Avail: CFSTI

The principles of determining radar scattering amplitude, scattering cross section, absorption and extinction cross sections, and the differential scattering cross section are briefly defined, followed by a general discussion of methods for long and short wave measurements of radar target areas. Rayleigh scattering is assumed for long waves, while physical optics are applied to short wave scattering from surfaces. The stationary phase principle for straight infinite edges is used for scattering from edges. Explicit expressions are given for a large number of bodies of simple geometric shapes. A method for calculating composite radar targets in the shape of aircraft and measured values for missile-shaped bodies are presented. Transl. by K.W.

N69-35279# Army Foreign Science and Technology Center, Washington, D.C.
INFORMATION THEORY AND PROBLEMS OF SHORT-RANGE RADAR
I. M. Kogan 2 May 1969 148 p refs Transl. into ENGLISH of the book "Teoriya Informatsii i Problemy Blizhnei Radiokokastii" Moscow, Izd. Sovetskoe Radio, 1968 p 1–144
(AD-688562; FSTC-HT-23-446-68) Avail: CFSTI CSCL 17/9

General theoretical principles of investigating the problems of the interaction of a number of radar systems which make up a complex in the tactical and technological characteristics of their interrelations are being developed on the basis of the ideas of information theory. These theoretical principles are based on basic engineering data and make it possible to obtain practical recommendations about means of creating systems which fulfill specific tactical technological requirements. The specific nature of short-range radar systems, the characteristic feature determining all of their main singularities of which is the commensurability of range with the geometric dimensions of interacting targets and with errors in issuing executive commands is examined. In the information theory aspect, a theory of multichannel mutual-correlation systems is given which expands the possibility of improving characteristics of efficiency, interference resistance and reliability of short-range systems. Author (TAB)

N69-35291*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE TEMS APOLLO-SATURN 5 TRACKING SYSTEM ERROR MODEL RESULTS THROUGH THE AS-504 FLIGHT TEST
Bobby G. Junkin 5 Jun. 1969 48 p refs
(NASA-TM-X-53848) Avail: CFSTI

Apollo-Saturn 5 truncated C-band radar tracker error model results obtained on the AS 501-504 flight tests are presented. It is shown that the coefficient standard deviation of the azimuth servo lag error model term for the Bermuda radars is significantly less than the values obtained for the Cape and Grand Bahama radars. The error model terms with the highest frequency of occurrence are found to be the servo lag terms in azimuth and elevation, and the scale factor and timing delay terms in range. Author

N69-35357# Academia R. P. R., Bucharest. Institutul de Fizica Atomica.
QUANTITY OF RADIOGRAPHIC QUALITY
Iulian Penaitescu [1968] 13 p refs Presented at 3rd Conf. on Nondestructive Testing, Gottwaldow, Czechoslovakia, Sep. 1968
(IFA-M-41; CONF-680951-1) Avail: AEC Depository Libraries

The concept of radiographic image quality is defined and analyzed in terms of the informational content of the image, using the methods of information theory. It is shown that contrast, sharpness and graininess are the main elements that determine the quality of an image. These elements are related to the more general concepts of modulation transfer function and noise. Two properties of the information channel are discussed: sensitivity, based mainly on contrast, and resolving power, based mainly on definition (a property inversely related to sharpness and graininess). Natural or artificial flaws are classified into critical and overcritical ones, according to their cross section. The image of critical flaws is sensitive to definition whereas the image of overcritical ones is sensitive only to contrast. The design and use of image quality indicators (IQI) are critically discussed, with respect to their informational properties. More comprehensive IQI's and image quality indexes are discussed. Author (NSA)

N69-35450# Vitro Labs., West Orange, N.J.
SUPPORTING STUDIES FOR SONAR SYSTEM RANGE PREDICTIONS, PHASE 1 Final Report, 11 Jul. 1968–11 Feb. 1969
R. O. Davidson and G. A. Brown 17 Mar. 1969 7 p refs
(Contract N00140-69-C-0021)
(AD-686476; VL-1028-14-0) Avail: CFSTI CSCL 17/1

During this phase of the contract work was performed in the following areas: (1) Signal excess level contours were computed for several sonar systems operating in various oceanographic areas. (2) Techniques were developed whereby geometrical spreading losses for unequal source/receiver sound velocities can be predicted on the basis of corrections to predictions made for equal source/receiver sound velocities. (3) A computer program for generating propagation loss under shallow water and varying bottom depth conditions, via a normal mode solution, was written. (4) A prediction system for providing average sound velocity to convergence zones in the Mediterranean Sea was developed. (5) The geometrical spreading loss prediction system developed under Contract N140(70024)76683B was modified to greatly increase its utility. (6) Studies were conducted to determine the feasibility of using correction factors on surface-to-surface data to obtain signal excess contours for below surface operations. Author (TAB)

N69-35464*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN EFFECTIVE AUTOMATIC DATA PROCESSING SYSTEM FOR PPM AND PCM TELEMETRY IN SOUNDING ROCKETS (ADP FEASIBILITY STUDY)
R. J. Stattel, P. L. Hinds, and G. U. Bell Mar. 1969 26 p refs
(NASA-TM-X-63828; X-721-69-70) Avail: CFSTI CSCL 17B

This study examines possible future expansion of the existing pulse position modulation (PPM) system. The growing frequency of the use of PPM telemetry in an annually increasing number of rocket flights demands such an inquiry. The primary goals of the present study are reduction in operational costs, and increased speed in providing the experimenters with the final reduced data. The integration of an on-line automatic data-processing (ADP) unit, to be located in existing facilities at White Sands (the primary PPM launch site), is proposed. The use of automatic data processing will provide system adaptability to the growing diversity in modulation methods of the recovered data. ADP will also save data processing man-hours and greatly reduce the recovery-to-reduction interval. The planned system is of such flexibility as to permit continued use, and further savings, when such innovations as the shift to S-band frequencies, and the use of pulse code modulation (PCM) systems in sounding rockets, are completed by 1970. Author

N69-35474# Forsvarets Forskningsanstalt, Stockholm (Sweden).
EFFECT OF ROCKET FLAMES ON ELECTROMAGNETIC WAVES, PART 2 [RAKETFLAMMORS INVERKAN PA ELEKTROMAGNETISKA VAGOR, DEL 2]
Staffan Quensel Nov. 1967 22 p refs In SWEDISH
(FOA-2-A-2507-55) Avail: CFSTI

The reflection and scattering mechanisms of electromagnetic waves interacting with rocket flames are discussed. Reflection from the flame is responsible for the coherent component of the scattered radiation, while flame turbulence and irregularities in the electron density are responsible for the partially coherent component. Some of the consequences of the scattering for the control of rockets are pointed out. A one-dimensional scattering model, the correlation functions for electron flux density, and a numberical analysis of the partially coherent scattering are presented. A simple experimental arrangement is outlined. Transl. by K.W.

N69-35485# Raytheon Co., Sudbury, Mass. Space and Information Systems Div.
REPORT ON APPLIED RESEARCH PROGRAM IN ELECTROMAGNETIC ENERGY RAY PATHS. PART 4: HANDBOOK OF PROGRAMS IN ELECTROMAGNETIC RAY PATHS Final Report, May 1966-Jul. 1967
Irwin Shear, Ralph R. Bravoco, and Alfred Simon 3 Feb. 1969 202 p refs
(Contract AF 19(628)-5032)
(AD-686168; R69-4072-3; AFCRL-69-0078-Pt-4) Avail: CFSTI CSCL 20/14

The volume is designed to aid in the transition of computer programs to the computer center of the Air Force Cambridge Research Laboratories. The programming package described herein, includes Hamiltonian Ray Tracing without magnetic field, HRT-2, and other programs used to display or generate electron density subroutines. Author (TAB)

N69-35486# Raytheon Co., Sudbury, Mass. Space and Information Systems Div.
REPORT ON APPLIED RESEARCH PROGRAM IN ELECTROMAGNETIC ENERGY RAY PATHS. PART 2: ANALYTICAL DESCRIPTION Final Report, May 1966-Jul. 1967
Irwin Shear, Ralph R. Bravoco, and Alfred Simon 3 Feb. 1969 144 p refs
(Contract AF 19(628)-5032)
(AD-686167; R69-4072-1; AFCRL-69-0078-pt-2) Avail: CFSTI CSCL 20/14

The report is subdivided into 3 major sections: (1) General description of the ray tracking method. (2) Work performed in these problem areas. (3) A summary of all work produced. Efforts were made in ionogram reduction and data smoothing for use in a Hamiltonian ray tracing program which uses Haselgrove's form of Hamilton's electromagnetic wave equations. Emphasis in this work has been placed on analog to digital as well as possible digital to hybrid compatibility. Power losses due to refraction and inverse square law spreading have been computed using a single ray approach. The method is fully described. Ray tracking has been done with and without magnetic field. Comparison of these results led to the discovery that the magnetic field has a pronounced effect on the ray path even at frequencies much greater than 15 MHz when the path traveled is north-south, or along magnetic field lines. Tabulated results and the underlying factors in the argument are presented. Part II supercedes part I of this series of reports. Author (TAB)

N69-35557# Forsvarets Forskningsanstalt, Stockholm (Sweden).
RADIATION DIAGRAMS FOR ANTENNAS OF THE XD AIRCRAFT [STRALNINGSDIAGRAMMAETNINGAR PA ANTENNER TILL FPL 35 X D]
Harry Bengtsson Nov. 1967 12 p In SWEDISH
(FOA-3-C-3537-61) Avail: CFSTI

A 1 : 10 scale model of the SAAB 35 XD aircraft was used to determine optimum placements of antennas and external stores and to measure radiation patterns. The work covered antennas for UHF communication and missile control, for the Tacan navigation system, and for the IFF identification system. Radiation patterns were measured with and without external rocket pods and fuel tanks. Transl. by K.W.

N69-35727# Fondazione Ugo Bordoni, Rome (Italy).
SOME POSSIBLE WAYS OF IMPROVING ECHO-SUPPRESSORS FOR SATELLITE TELEPHONE COMMUNICATIONS
Luigi Giacomelli, Bruno Peroni (Rome Univ.), and Aldo Roveri 15 Sep. 1967 18 p refs Presented at CCITT Study Group XV, Lisbon, Sep. 1967 Sponsored by Consiglio Nazl. delle Ric.
Avail: CFSTI

Under particular service conditions echo suppressors used for satellite transmissions cause incomplete suppression of the echo signal and speech chopping during double talking. This report concerns the design of echo-suppressors particularily suited to the long delays encountered in satellite communications. Developments took place as follows: a) study of the engineering problems arising when echo suppression is carried out without interrupting the send path, precisely when a method is employed which is based on the automatic echo-neutralization; b) performance of echo-suppressor when its receive control path signal is delayed by twice the propagation time between the device and the point of reflection; c) new echo-suppressor performance with frequency selective working operation based on the spectral properties of the speech signal. Author (ESRO)

N69-35731*# ADCOM, Inc., Cambridge, Mass.
DESIGN CRITERIA FOR RADAR TRACKING SYSTEMS Final Report
Howard C. Salwen and David M. Warren 19 Apr. 1968 92 p refs
(NASA Order Er-13784)
(NASA-CR-86213) Avail: CFSTI CSCL 17I

The theoretical aspects of the radar tracking problem are reviewed. Derivations are given to show the importance of matched filters, ambiguity diagrams and maximum likelihood detectors to radar system design. The practical aspects of radar system design are discussed. In particular, the precision obtainable from phase-locked loops, split gate trackers, leading edge trackers and harmonic range tone trackers are derived in terms of their design parameters and performance requirements. Author

N69-35768*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
VLF MEASUREMENTS OF THE POYNTING FLUX ALONG THE GEOMAGNETIC FIELD WITH THE INJUN 5 SATELLITE
Stephen R. Mosier and Donald A. Gurnett Jun. 1969 40 p refs
(Contracts NAS5-10625; NAS1-8141; NAS1-8144; NAS1-8150; Grant NGR-16-001-043; Contract Nonr-1509(06))
(NASA-CR-105427; Rept-69-27) Avail: CFSTI CSCL 17B

The direction of the Poynting flux, up or down the geomagnetic field, has been determined for several types of VLF radio noise phenomena observed with the Injun 5 satellite, thereby providing

information about the source region of these waves and their propagation in the ionosphere. Determinations of the Poynting flux direction of proton whistlers show that they are propagating up the geomagnetic field lines in accordance with the accepted theory of proton whistler propagation, thus providing a good check on the experimental technique. Initial measurements are presented on the Poynting flux direction of the ELF hiss, periodic emissions, VLF hiss, and chorus. Of particular interest is a new type of VLF emission called a saucer which is found to be propagating upward from a source below the satellite. A qualitative explanation of the frequency-time shape of this new type of emission is presented. Author

N69-35784*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

OPTICAL COMMUNICATION THROUGH MULTIPLE-SCATTERING MEDIA

Harold M. Heggestad 22 Nov. 1968 116 p refs

(Grant NGL-22-009-013; Contract DA-28-043-AMC-02536(E); Proj. 200-14501-B31F)

(NASA-CR-105390; TR-472; TR-454) Avail: CFSTI CSCL 17B

A model is developed for the effects of multiple scattering upon optical frequency radiation. Attention is focused upon situations in which the scattering particles are large compared to the carrier wavelength, so that forward scattering predominates as in optically dense atmospheric clouds. The spatial variation of the intensity of light beneath a cloud subjected to continuous-wave illumination is modeled as the output of a multidimensional linear system. The approximate impulse response of the system is determined, in two complementary forms, and the approximate response below the cloud under arbitrary illumination is shown to be given by a linear superposition integral. In general, the spatial behavior is representable as a joint function of angle of arrival and horizontal coordinates over the ground. The field on the ground is shown to be representable in terms of a complex Gaussian random process. A complete statistical description of the process is provided by its mean (which is zero) and its correlation function. The time--space correlation function is written in terms of a generalized scattering function combining all the time, frequency, and spatial information. Author

N69-35825# Siemens A.G., Munich (West Germany). Zentrallaboratorium fuer Nachrichtentechnik.

THEORETICAL INVESTIGATION OF THE PRINCIPLES AND THE DESIGN OF EQUIPMENT FOR CARRIER ENERGY DISPERSAL [THEORETISCHE UNTERSUCHUNG DER PRINZIPIEN UND AUFBAU VON EINRICHTUNGEN FUER DIE TRAEGER-ENERGIEVERWISCHUNG]

K. Pohler May 1969 119 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. für Wiss. Forsch.

(BMwF-FB-W-69-19) Avail: CFSTI

Based on the physical assumptions related to frequency modulation and technical requirements for multiple-carrier operation via satellites, the dispersal signal, spectral energy distribution, bandwidth requirements, and the influence of dispersal on the signal-to-noise ratio are discussed. Possibilities of application of carrier dispersal to multichannel telephony and television are analyzed and an optimum method is selected for each case. Finally a circuit description of the selected dispersal equipment and a summary concerning interaction with the modulating equipment is given. Author (ESRO)

N69-35841*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

RESEARCH AND ADVANCED DEVELOPMENT. VOLUME 3: OTDA Semiannual Review, 1 Jul. – 31 Dec. 1968

15 Feb. 1969 48 p refs

(Contract NAS7-100)

(NASA-CR-105432; JPL-701-23-Vol-3) Copyright. Avail: CFSTI CSCL 17B

All supporting research and technology in progress at the Jet Propulsion Laboratory during the period July 1 to December 31, 1968 under the direction of the JPL Office of Research and Advanced Development, for the NASA Office of Tracking and Data Acquisition (New Systems and Spacecraft Subsystems) are reviewed. The work units are arranged in numerical sequence by NASA code in each subject section. The research and advanced development results published during this report period are listed under each work unit. Author

N69-35887# Royal Aircraft Establishment, Farnborough (England).

VLF PHASE DELAY VARIABILITY AND THE DESIGN OF LONG RANGE NAVIGATION AIDS

B. Burgess Jun. 1968 26 p refs Presented at the 13th AGARD Electromagnetic Wave Propagation Comm. Symp., Ankara, 9–12 Oct. 1967

(RAE-TR-68145) Avail: CFSTI

Worldwide navigation using VLF radio waves is possible because of the very low signal attenuation rates associated with this band of frequencies. In the Omega navigation system, use is made of the lower end of the VLF band, viz. 10–14 kHz, and phase comparison of transmissions from a complex of 8 transmitters on the surface of the earth provide a network of lines of position. The accuracy of the system, and also the ability to identify unambiguously lines of position in the system, ultimately depends on the propagation characteristics of the medium. A review is given of the experimentally determined characteristics of the propagation of VLF radio waves to great distances in the earth ionosphere waveguide, and these characteristics are examined in the light of waveguide mode theory. In particular the phase delay variations as a function of frequency, distance from transmitter, time of day, year, solar activity are discussed. Most of this experimental data refers to frequencies of 16 kHz and above, and detailed information on frequencies in the lower portion of the VLF band (10–14 kHz) has had to await the recent experimental Omega transmissions (1966 onwards). Included in this review is experimental data gathered during the past 12 months on Omega transmissions, and the role that the propagation data plays in the design of a navigation system such as Omega is brought out. Author (ESRO)

N69-35939# Ministry of Technology, London (England).

SOME POSSIBLE CONCEPTS FOR A SECOND PHASE OF COMMUNICATION SATELLITE DEVELOPMENTS IN EUROPE

N. Simmons 28 Apr. 1969 10 p refs Presented at the 9th Brit. Interplanet. Soc. European Space Symp., London, 14–16 May 1969

Avail: CFSTI

The requirement for distribution of television programmes in Europe in the period 1975–1985 is examined as a possible theme for the second phase of developments to follow the Eurovision project. It is shown that a system of semi-direct television using an intermediate satellite should be by far the cheapest available method. It would also be economic in terms of frequency spectrum and possess other advantages. The savings as compared with conventional, ground-station distribution, even when the system is loaded with the full costs of launcher development, appear to be substantial. Adoption of this theme could reverse the notion of space as a heavy liability and promote a situation in which other useful application projects might proceed. Author (ESRO)

N69-35941# Library of Congress, Washington, D.C. Aerospace Technology Div.
TRACKING OF MISSILES AND SPACE VEHICLES. Surveys of Foreign Scientific and Technical Literature, Sep. 1968 – Mar. 1969
Ivan Velinov 20 Aug. 1969 94 p refs *Its* Work Assignment No. 12
(ATD-69-101-12-2; Rept-30) Avail: CFSTI

The equipment and research program of European Satellite Observation Stations are described. The station inventory includes an AT-1 telescope, a Ulysse Nardin chronometer, an Edystone receiver, TZK binoculars, and a Becvar sky atlas. The stations participate in the INTEROBS program in simultaneous observations of satellites for the purpose of determining short period atmospheric density changes. A 22-m parabolic reflector radio telescope is also described. This radio telescope has a focal length of 9525 mm and an angular aperture of 2 $\psi = 120°$. The guidance system provides completely automatic operations for any solar observation or satellite observation. Author

N69-35982# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Institut fuer Satellitenelektronik.
UNIVERSAL DATA PROCESSING SYSTEM FOR TELEMETRY SIGNALS [UNIVERSELLE DATENAUFBEREITUNGSANLAGE FUER TELEMETRIESIGNALE]
Wolfgang Papke *In its* DVL News, No. 39 Mar. 1969 p 454 – 456 (See N69-35976 20-34)
Avail: CFSTI

The transmission of signals produced onboard spacecraft to ground stations by PCM telemetry is described, noting analog-to-digital converters attached to a multiplexer, a Honeywell DDP 116 central processor, and simulation of telemetry data for test purposes. ESRO

N69-35987# Weapons Research Establishment, Adelaide (Australia).
A DATA-HANDLING SYSTEM FOR INFORMATION TELEMETERED FROM THE SATELLITE WRESAT
A. P. Clarke and W. R. Anthoney Dec. 1968 23 p refs
(WRE-TN-TSD-32) Avail: CFSTI

This paper outlines the system developed by the authors to handle the PAM/FM telemetry signal recorded from the WRESAT PAM/FM/PM telemetry transmission. A novel feature of this data handling system is the emphasis on the use of a digital computer. This feature is discussed in detail, and reference is made to the limitations of the method. Author

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N69-34602# Electrotechnical Lab., Tokyo (Japan).
STUDIES ON FAIL-SAFE LOGICAL SYSTEMS
Seiji Tsuchiya Jan. 1969 93 p refs In JAPANESE; ENGLISH summary *Its* Res. No. 695
Avail: CFSTI

Described is the concrete construction method of logical circuits based on the concept of fail-safe. The circuits are schemed to take the safe side when failure occurs in the system. The construction is based on the concept of maximum potential for logical elements. Some examples are presented on the uses of the system. Author

N69-34627*# Bellcomm, Inc., Washington, D.C.
AEROSPACE DIGITAL COMPUTER DESIGN TRENDS
Donald O. Baechler 14 Jan. 1969 14 p ref Submitted for publication
(Contract NASw-417)
(NASA-CR-103952) Avail: CFSTI CSCL 09B

The recent trends in aerospace computer design that can be inferred from the changing characteristics of computers developed during the period 1962 – 1968 are summarized. Characteristics of the 60 computers are given. Author

N69-34632# Massachusetts Inst. of Tech., Cambridge.
SENSITIVE ISSUES IN THE DESIGN OF MULTI-USE SYSTEMS
F. J. Corbato 12 Dec. 1968 18 p Presented at the Symp. on Advances in Software Technology, Waltham, Mass., Feb. 1968
(Contract Nonr-4102(01); Proj. MAC)
(AD-688560; MAC-M-383) Avail: CFSTI CSCL 9/2

An attempt is made to isolate and discuss fifteen critical issues ranging from technical to managerial which affect the complexity and difficulty of constructing computer systems which serve multiple users. Author (TAB)

N69-34702# Illinois Univ., Urbana. Dept. of Computer Science.
DEPARTMENT OF COMPUTER SCIENCE. Quarterly Technical Progress Report, Jul. – Sep. 1968
Sep. 1968 199 p refs
(Contracts AT(11-1)-1469; AT(11-1)-1018)
(COO-1469-111; COO-1018-1164) Avail: CFSTI

Developments in the circuit research program, hardware and software systems research, Illinois pattern recognition computer: ILLIAC 3, and ILLIAC 4 are reported. Also, switching theory and logical design developments, report of the statistical consultants, IBM system/360 service, IBM 7094/1401 service, use, and development, and general department information are outlined. NSA

N69-34726# Oakridge National Lab., Tenn. Director's Div.
COMPUTER ANALYSIS OF THREE-FACTOR INTERACTIONS IN CONTINGENCY TABLES
Marvin A. Kastenbaum May 1969 53 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-2569) Avail: CFSTI

Numerous methods were proposed for testing the hypothesis of zero three-factor interaction in contingency tables. These methods are incorporated into a single computer program which is designed to calculate the test statistics by any or all of the proposed techniques, and which also provides estimators of the interactions and corresponding two-sided confidence intervals. The program was written in ASA FORTRAN for the CDC-3600 and CDC 1604 computers, and will analyze interactions in contingency tables of dimensions 2 is less than or equal to r is less than or equal to 5, 2 is less than or equal to s is less than or equal to 5, 2 is less than or equal to t is less than or equal to 18, for r is less than or equal to s is less than or equal to t. Author (NSA)

N69-34797# United Kingdom Atomic Energy Authority, Harwell (England). Theoretical Physics Div.

A FORTRAN SUBROUTINE TO INVERT A RECTANGULAR MATRIX OF FULL RANK

M. J. D. Powell Apr. 1969 13 p refs

(AERE-R-6072) Avail: CFSTI; HMSO: 2s 6d

A FORTRAN subroutine is presented that calculates the generalized inverse of an $m \times n$ ($n \geq m$) matrix A, having rank m. A special feature of the method used is the economy of computer storage. The matrix A is over written by the required generalized inverse and, apart from the program itself and some constants, only $(2m + n)$ additional storage locations are required. Author (NSA)

N69-34816# Syracuse Univ., N.Y.

LARGE SCALE INFORMATION PROCESSING SYSTEM. VOLUME 1: COMPILER, NATURAL LANGUAGE, AND INFORMATION PROCESSING Annual Report, 16 Jul. 1967 – 15 Jul. 1968

Philip L. Peterson, Robert Carnes, Ilene Reid, Edward T. Feng, and Robert G. Sargent Griffiss AFB, N.Y. RADC Apr. 1969 142 p refs

(Contract F30602-68-C-0013)

(AD-687840; RADC-TR-68-401-Vol-1; AR-1) Avail: CFSTI CSCL 9/2

The report covers (1) semantics and grammar, (2) context theory of meaning, (3) information retrieval, and (4) text processing and manipulation. Author (TAB)

N69-34817# Syracuse Univ., N.Y.

LARGE SCALE INFORMATION PROCESSING SYSTEM. VOLUME 2: SYSTEMS: THEORY, ADVANCED CONCEPTS AND DESIGNS Annual Report, 16 Jul. 1967 – 15 Jul. 1969

Philip L. Peterson, Robert Carnes, Ilene Reid, Edward J. O'Connell, and Pauline Atherton Griffiss AFB, N.Y. RADC Apr. 1969 88 p refs

(Contract F30602-68-C-0013)

(AD-687841; RADC-TR-68-401-Vol-2; AR-1) Avail: CFSTI CSCL 9/2

The impact of an interpretive implementation of a language having a number of powerful primative operators upon language processors for interactive terminal computing systems is discussed. After presenting a comparison of the attractive features of compilers and interpreters, the nature of IBM's APL/360 language is discussed in detail necessary to illustrate the comparison of features. Author (TAB)

N69-34818# Syracuse Univ., N.Y.

LARGE SCALE INFORMATION PROCESSING SYSTEM. VOLUME 3: MODEL BUILDING AND EDUCATIONAL USE OF COMPUTERS Annual Report, 16 Jul. 1967 – 15 Jul. 1968

Philip L. Peterson, Robert Carnes, Ilene Reid, Edward J. O'Connell, and Pauline Atherton Griffiss AFB, N.Y. RADC Apr. 1969 145 p refs

(Contract F30602-68-C-0013)

(AD-687842; RADC-TR-68-401-Vol-3; AR-1) Avail: CFSTI CSCL 9/2

The report covers (1) computer-aided design of inventory systems, (2) computer-aided education, (3) computer-aided instruction, and (4) computer-aided movie-making for cheap rapid production of training films. Author (TAB)

N69-34819# Brookhaven National Lab., Upton, N.Y. Nuclear Engineering Dept.

FUDGE 4A: A COMPUTER PROGRAM FOR GAMMA DOSE RATE DISTRIBUTION FROM RECTANGULAR SOURCES

Leonard Galanter and Krishnaswamy Krishnamurthy Aug. 1968 28 p refs Sponsored by AEC

(BNL-50126) Avail: CFSTI

A computer program, FUDGE 4A, is presented that is used to determine the distribution of gamma dose to large volume targets from rectangular source plaques. The program was written for FORTRAN 4 for the CDC-6600. NSA

N69-34822# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.

CONVOLUTE METHOD OF SMOOTHING OR CALCULATING THE TIME DERIVATIVES OF A SIGNAL RECORDED IN DIGITAL FORM AT EQUAL TIME INTERVALS

T. G. Kollie, D. L. Mc Elroy, and C. R. Brooks Apr. 1969 25 p refs

(W-7405-ENG-26)

(ORNL-TM-2517; PB-183555) Avail: CFSTI CSCL 09B

A method based on the principle of least squares is presented for smoothing the magnitude of a rapidly varying signal which has been recorded in digital form at equal intervals of time. The extension of this smoothing method to the calculation of the time rate of change is demonstrated in detail. FORTRAN codes are listed for the smoothing technique as well as for the calculation of the time rate of change. Although these codes are for the particular case of a three-parameter fit, the changes necessary for use of a larger number of parameters are outlined. The changes necessary for the calculation of higher order derivatives are discussed. An example of the use of the smoothing technique is included. Author (USGRDR)

N69-34920# Stanford Linear Accelerator Center, Calif.

CIL: COMPILER IMPLEMENTATION LANGUAGE

David Gries Mar. 1969 119 p refs

(Contract AT(04-3)-515)

(SLAC-102; UC-32) Avail: CFSTI

The compiler implementation language, designed for writing compilers for the IBM 360 computers, is described. The heart of the system is a procedure oriented ALGOL-like language with expressions, assignment statements, iterative statements, etc. However, the basic data types of the language are those of the IBM 360 — byte, halfword integer, sequence of 1 to 256 bytes, etc—while the basic operations on these types of data are also those of the 360. This should allow the compiler writer to have more feeling for the code generated by the metacompiler and thus make it possible to write more efficient compilers. NSA

N69-34974*# Santa Clara Univ., Calif. Dept. of Electrical Engineering.

PROPERTIES OF SUMS OF PSEUDO-RANDOM VARIABLES IN FEEDBACK SHIFT REGISTERS Final Report

Timothy J. Healy 1 Jun. 1969 56 p refs Sponsored by NASA

(NASA-CR-73356) Avail: CFSTI CSCL 09B

The problem of the sum of values in feedback shift registers is considered. A method of synthesizing pseudo-random distributions is developed, while partial results are displayed in the form of frequency histograms. It is shown that several important distributions such as uniform, triangular, stairstep, and bimodal are easily synthesized. The characteristic polynomial is discussed in connection with two alternative methods, adding stages and additional logic, to change the available distributions from the feedback shift registers. Infinite products of equations are given and distribution functions are found to be uniform to approximately Gaussian. J.M.C.

N69-34985# Sandia Corp., Albuquerque, N. Mex.
COMPUTER-AIDED RELIABILITY AND QUALITY ANALYSIS OF ELECTRONIC CIRCUITS
Clint Purdue 1968 16 p refs Sponsored by AEC
(PB-183452; SC-DR-69-1731) Avail: CFSTI

Using appropriate programs, the designer and analyst can now simulate many circuits on the computer and optimize the desired performance characteristics. The manner in which a computer, combined with programs such as ECAP, NET-1 CIRCUS, and SCEPTRE can be used to assist the engineer achieve designed-in quality and reliability characteristics, is described. Author (USGRDR)

N69-35018# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
FEATS: A COMPUTER PROGRAM FOR THE FINITE ELEMENT THERMAL STRESS ANALYSIS OF PLANE OR AXISYMMETRIC SOLIDS
J. A. Swanson Dec. 1968 142 p refs
(WANL-TME-1888) Avail: CFSTI

A new coupled two-dimensional temperature stress code developed at Westinghouse Astronuclear Laboratory in support of the NERVA (Nuclear Engine for Rocket Vehicle Application) Program (Contract NP-1) called FEATS (Finite Element Analysis – Temperature and Stress) is described. This code calculates, by finite element analysis, the temperature and stress fields for either axisymmetric conditions including prescribed displacements, loads, and temperature boundary conditions. A description of the required input data cards is presented along with several examples illustrating the operation of the program. FEATS is written in FORTRAN 4 for the CDC 6600 or IBM 360/75 computers. Author (NSA)

N69-35074*# Arizona Univ., Tucson. Dept. of Electrical Engineering.
A GRID SEARCH OPTIMIZATION SUBROUTINE FOR USE WITH THE GOSPEL OPTIMIZATION SOFTWARE PACKAGE
L. P. Huelsman and G. R. Allgaier Jun. 1969 21 p ref
(Grant NGL-03-002-136)
(NASA-CR-104133) Avail: CFSTI CSCL 09B

This report describes a subroutine implementing an optimization strategy which supplements those described in an earlier report. The strategy is a grid search. The results obtained from applying this strategy to a pair of test problems are discussed. Author

N69-35089*# Harvard Coll. Observatory, Cambridge, Mass.
FINAL DOCUMENTATION OF THE LUNAR PROGRAM AND EMENDATIONS TO SCIENTIFIC REPORT NO. 9
John B. Newell Mar. 1969 41 p
(Grant NGR-22-007-001)
(NASA-CR-104119; SR-9A) Avail: CFSTI CSCL 09B

Computer program debugging activity with specific emendations and a complete printout of the emended data processing program is reported as supplementary material on the data processing of lunar infrared measurements at high spatial and radiometric resolution to obtain brightness temperatures. Author

N69-35132*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
AS-503 POST LAUNCH SOFTWARE ASSESSMENT
3 Feb. 1969 32 p
(NASA-TM-X-61786; GP-628) Avail: CFSTI CSCL 09B

The outstanding Saturn launch computer complex software problems and anomalies that occurred during the countdown of AS-503 are summarized. The problems shown as unresolved have been submitted for corrective action on future software deliveries. In addition, the report contains the AS-503 computer software configuration, the procedural workaround, the terminal program output, the program events, the cycling discrete groups, and the major test problems. Author

N69-35203# United Kingdom Atomic Energy Authority, Harwell (England). Electronics and Applied Physics Div.
MAGNETIC TAPE TRANSPORT FOR DIGITAL LOGGING
A. Lewis Aug. 1968 22 p refs
(AERE-R-5862) Avail: CFSTI; HMSO: 3s 6d

A tape transport was designed for digital data logging operations in which the tape speed is continuously variable from 0.5 to 250 inches per second. The speed may be controlled by the input data rate to maintain approximately constant word density on the tape. A maximum skew of 150 microinches across 1" tape is maintained with all speeds in either direction of tape travel and over different transports. Seventeen transports were made to the design and after 10,000 hours the performance specification is maintained. Author (NSA)

N69-35204# United Kingdom Atomic Energy Authority, Harwell (England). Material Physics Div.
CASSANDRA: A MEGACHANNEL TIME-OF-FLIGHT ANALYSER
J. W. Hall Nov. 1968 13 p refs
(AERE-R-5962) Avail: CFSTI; HMSO: 3s

CASSANDRA is a data collection system for neutron time-of-flight experiments. It can process up to 300 events per second, updating any of half a million counting channels within 8 seconds. The CASSANDRA system is based on the PDP-8; it uses DEC-tape and magnetic drum backing store and has a closed circuit T.V. system looking at a DEC Type 34D display to give remote displays of data. A special interface unit is used to provide feedback from these displays. The CASSANDRA programs control the collection and sorting of data and provide a sophisticated command system that allows unskilled operators to make full use of the equipment. Author (NSA)

N69-35272*# North Caroline State Univ., Raleigh. Dept. of Electrical Engineering.
A STUDY OF OPTICAL DATA PROCESSING AND REDUCTION Final Report, 1 Jul. 1966 – 31 Mar. 1969
F. J. Tischer 30 Jun. 1969 32 p refs
(Grant NGR-34-002-038)
(NASA-CR-104088) Avail: CFSTI CSCL 09B

Signal detection and nonlinearities in the noise of coherent optical data processors were investigated. Error analysis and the fabrication of devices to eliminate or reduce these effects were made. The noise-to-signal ratio was adopted as the characteristic quantity which defined a large group of devices which produced the same nonlinear noise. A prototype device, the function linearizer, was fabricated and it functioned in compensating the nonlinearities of cathode ray tubes. A new method for the description of nonlinear effects in signals was sought; Chebyshev polynomials were considered most suitable. Computer programs were written to evaluate nonlinearities in photographic plates and film; diagrams which demonstrate these effects are included. A study of nonlinear effects in holography by Chebyshev polynomials extended the results of these studies. M.H.E.

N69-35283# Stanford Univ., Calif.
HARDWARE AND SOFTWARE FOR EFFECTIVE MAN-MACHINE INTERACTION IN THE LABORATORY
W. F. Miller Mar. 1969 18 p refs Presented at Conf. on Computer Systems in Exptl. Nucl. Phys., Skytop, Pa., 3-6 Mar. 1969 Sponsored by AEC
(SLAC-PUB-573) Avail: CFSTI

The development of computer meta-systems and research on models of control at Stanford University are outlined. The meta-system GLAF for graphics and pattern recognition is briefly described. NSA

N69-35363# RAND Corp., Santa Monica, Calif.
SOVIET CYBERNETICS: RECENT NEWS ITEMS, VOLUME 3, NUMBER 3, 1969
Dorothy Mc Donald ed., and Wade B. Holland ed. Mar. 1969 72 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-687079; RM-6000/3-PR) Avail: CFSTI CSCL 9/2

The issue features an article on small computers and a progress report on the state network of computing centers. Two articles, one popular and one technical, describe the planned Sirena-1 system for airline reservations. The system differs from western systems in two respects: (1) it does not apply to all of aeroflot's ticket sales and reservations, but only to the Moscow Airport, with some tie-ins to other major airports for return flights to Moscow, (2) it provides automated printing for individual passenger tickets. A description of the computer science curricular and support activities of Moscow State University is provided by an article on the University computer center, other items of interest include (1) a biography of academician, engineer-admiral Aksels I. Berg, on the occasion of his 75th birthday; (2) a critique on how scientists spend their working hours; (3) an article on the Lvov information control system (designed by Glushkow for the Lvov TV factory), which the Ukranian Academy of Sciences has ordered to be generalized for use in a wide range of factories engaged in mass production of a limited variety of products. Author (TAB)

N69-35400# Forsvarets Forskningsanstalt, Stockholm (Sweden).
DIGITAL CALCULATOR FOR SIMULATING A HYBRID CONTROL SYSTEM [DIGITAL RAEKNEENHET FOER SIMULERING AV HYBRIDREGLERSYSTEM]
E. Astroem Oct. 1967 42 p refs In SWEDISH
(FOA-2-C-2195-54) Avail: CFSTI

A simple incremental-type calculator has been designed and constructed based on the principle of the digital-frequency method, i.e., using a combination of binary and pulse frequency circuits. The apparatus consists of two signal-sensitive reversible calculators (digital integrators), one of which is combined with a binary modulator; two digital-to-analog converters; a four-phase generator; a synchronizer for signal correlation; and the necessary input-output circuits. Operation and logic circuits of the apparatus are described. Transl. by K.W.

N69-35420# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
MULTIPLEXED COMMAND AND CONTROL BY DIGITAL COMPUTER OF IRRADIATED FURNACES [SURVEILLANCE ET REGULATION MULTIPLEXEE PAR CALCULATEUR NUMERIQUE DE FOURS IRRADIES]
Raymond Joumard (Ph.D. Thesis--Grenoble Univ., 27 Jul. 1967) Apr. 1969 223 p In FRENCH; ENGLISH summary
(CEA-R-3407) Avail: CFSTI

An experimental direct digital control system has been realized in order to verify that a computer facilitates the control of the experiments done in the nuclear reactors and to solve the theoretical and technical difficulties. The regulation is applied to thermal processes. The sampled data systems theory permits to choose the type of an efficient and simple digital compensator, and to establish a diagram which gives the values of the correcting parameters (obtained by minimizing the difference between the output and the input when perturbations occur). The program executes, in simultaneity, command and control. Complex possibilities of printing out measures and alarms existed. The computer works out an incremental correction which makes step motors turn. These motors act on the heating organs. The theoretical values and answers have been confirmed. The accuracy was limited essentially by the input quantification (1/1000th). Author (ESRO)

N69-35421# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
BINARY ANALYSIS. PART 2: APPLICATIONS AND FUNCTIONS OF TRANSCODING [ANALYSE BINAIRE. DEUXIEME PARTIE: APPLICATIONS ET FONCTIONS DE TRANSCODAGE]
Rene-Louis Vallee May 1969 67 p In FRENCH; ENGLISH summary
(CEA-R-3534-2) Avail: CFSTI

The study of binary groups under their mathematical aspects constitutes the matter of binary analysis, the purpose of which consists in developing altogether simple, rigorous and practical methods needed by the technicians, the engineers and all those who may be mainly concerned with digital processing. This subject, fast extending if not yet determining, however tends actually to play a main part in nuclear electronics as well as in several other research areas. Author (ESRO)

N69-35443*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RECENT IMPROVEMENTS IN THE ISPD-3 COMPUTER
Rodger A. Cliff Aug. 1969 28 p refs
(NASA-TM-X-63632; X-711-69-320) Avail: CFSTI CSCL 09B

The Spacecraft Data Processor-3 is a small serial computer which will be flown as an engineering experiment on the IMP-I (eye) spacecraft. In this application it will handle data acquisition for four of the scientific experiments. Modifications to the SDP-3 which improve its operation with little change in hardware complexity include: (1) permitting full-word indirect addressing in user mode for all instructions which do not modify the contents of memory, (2) extending output channel capability to cover all of memory, (3) a new subroutine linkage instruction, (4) a conditional skip on memory zero instruction, (5) byte oriented instructions, and (6) improved index register manipulation instructions. The use of 8-bit MSI shift registers produces a significant hardware and power saving at the expense of deleting all left-shifting instructions. Further hardware savings are realized with a special multiplication instruction which allows the MQ register to be deleted. As a result of these, and other, modifications the power dissipation of the SDP-3 has been decreased by 2/3 watt and the number of IC's by 260 while in most respects operation has either been unchanged or improved. Author

N69-35476# Forsvarets Forskningsanstalt, Stockholm (Sweden).
COMPUTER METHOD AND ROUTINE FOR CALCULATING INTERSECTION BETWEEN A STRAIGHT LINE AND SOLID GEOMETRICAL FIGURES [METODER OCH RUTINER SKAERNING MELLAN EN RAET LINJE OCH RYMDGEOMETRISKA FIGURER]

L. Oden Dec. 1967 24 p In SWEDISH
(FOA-2-C-2212-45) Avail: CFSTI

Methods and routines are presented for the reduction of programming and computing times in calculating intersecting coordinates on a computer. The routines are for straight elliptical cylinders, straight circular cylinders, straight elliptical cone stumps, infinite cones, rotational ellipsoids, polygons, polyhedrons, spheres, and straight circular cone stumps. All routines are written in FORTRAN 4 for the IBM 7090 computer. Transl. by K.W.

N69-35496# General Electric Co., Cincinnati, Ohio. Missile and Space Div.
DSPACE: A PROGRAM TO CALCULATE INTERPLANAR SPACINGS FROM LATTICE PARAMETERS
L. H. Sjodahl, S. F. Bartram, and R. C. Rau 11 Mar. 1969 10 p
(Contract AT(40-1)-2847)
(GEMP-680) Avail: CFSTI

DSPACE is a time-sharing computer program written in the old basic (ABASIC) language for calculating d-spacings for all planes with nonzero structure factors from the lattice parameters. The procedures for minimizing the number of calculations are described. A listing of the program and the tapes for several common crystal systems are included. NSA

N69-35569*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FORTRAN PROGRAM FOR MACHINE COMPUTATION OF GROUP TABLES OF FINITE GROUPS
Gabriel Allen, David D. Evans, and Paul Swigert Washington Sep. 1969 43 p refs
(NASA-TN-D-5402) Avail: CFSTI CSCL 09B

A FORTRAN program has been written for machine computation of group tables for finite groups. The use of the method depends on the fact that every finite group of order n is isomorphic to some subgroup of the symmetric group S_n. The procedure for using the program is as follows: After the proper isomorphism has been established, the appropriate elements of S_n are entered into the program as input data. The program computes and prints out the group table for these elements of S_n. Then the translation is made from the elements back to the original group elements. Two examples are shown. Author

N69-35613*# Wolf Research and Development Corp., Bladensburg, Md.
A SURVEY OF CURRENT DEBUGGING CONCEPTS
Wallace Kocher Washington NASA Aug. 1969 89 p refs
(Contract NAS5-9756-99)
(NASA-CR-1397) Avail: CFSTI CSCL 09B

The debugging of computer programs is analysed in terms of the localization and correction of errors. Current debugging concepts are presented with only logical and clerical errors considered. The computer program for the Interplanetary Monitoring Platform is documented with emphasis placed on the error diagnostic procedures. Proposals for developing software that will allow debugging to be conducted using the same language as the source program are included. F.O.S.

N69-35616# Reactor Centrum Nederland, Petten.
STRZ-2: AN ALGOL PROGRAM FOR THE CALCULATION OF THE STEADY-STATE TEMPERATURE DISTRIBUTION IN R-Z GEOMETRY WITH TEMPERATURE DEPENDENT HEAT CONDUCTION COEFFICIENTS AND RADIATION IN NARROW GAPS
H. P. Struch May 1969 72 p refs
(RCN-107) Avail: CFSTI

STRZ-2 is an Algol program for the calculation of the steady-state, rotationally symmetric temperature field in an inhomogeneous cylindrical body, in which heat production, radiation in narrow gaps, and heat conduction with temperature and direction dependent conduction coefficients may occur. At most 2000 mesh-points are allowed. STRZ-2 is a revised version of the original FORTRAN program STRZ. A new polynomial inner iteration procedure is applied, which reduces the number of inners to be executed by approximately a factor 2. Author (ESRO)

N69-35675# Sandia Corp., Albuquerque, N.Mex.
COMPUTER AIDED PRECISION GRAPHICS
W. C. Burd, T. I. Ristine, and R. E. Thompson [1969] 22 p refs Presented at the Natl. Conf. of the Assoc. for Precision Graphics, Dallas, Tex.
(SC-DC-69-1853-A; CONF-690605-1) Avail: CFSTI

A speech outline discussing how computerized techniques are utilized in the preparation of precision art work is presented. This outline elaborates on the use of Interactive Computer Graphics as a tool to verify and revise printed curcuit masters. Author (NSA)

N69-35690# Atomic Energy Establishment, Winfrith (England).
A USER'S GUIDE TO GENEX, SDR, AND RELATED COMPUTER CODES
R. J. Brissenden and C. Durston Aug. 1968 177 p refs
(AEEW-R-622) Avail: CFSTI

Development of the GENEX-SDR computer codes, started in August 1962, as a method for calculating fast reactor Doppler coefficients in the resonance region, has since been extended to the large-scale generation of cross-sections. These are generated by the code GENEX from resonance parameters generated by the code RESP and stored on tape. The codes The PODGE and SUNNY are used for evaluation of the input data to RESP, the former for the unresolved region and the latter, being a card-input version of GENEX, for the resolved region. The aim was to by-pass the various approximations that existed and to treat the resonance region in fine detail. The code was originally envisaged as covering the range from 65 keV to thermal energies, but machine time considerations caused this to be curtailed to range from 20 keV (approximately 120,000 groups). This was later extended to 25 keV to enable the analysis of antimony-beryllium source experiments to be carried out. NSA

N69-35697# Rocky Flats Div., Dow Chemical Co., Golden, Colo.
PLOT: A COMPUTER PROGRAM FOR AUTOMATIC GRAPH PLOTTING
Clinton R. Heiple 14 Mar. 1969 60 p
(Contract AT(29-1)-1106)
(REP-1259) Avail: CFSTI

A computer program, written in in FORTRAN 4G for the IBM 360, which generates the instructions necessary to plot graphs on the Gerber Series 2000 plotter is presented. The program can be used to plot virtually any type of two dimensional graph with rectangular axes. Appendices have been included so that future modifications of the program can be made with a minimum of difficulty. Author (NSA)

N69-35789# National Bureau of Standards, Washington, D.C.
CODASYL COBOL: JOURNAL OF DEVELOPMENT, 1968
Jul. 1969 330 p
(NBS-108) Avail: SOD $2.75

This document is a report to the COBOL community from the Conference on Data Systems Languages (CODASYL) Common Business Oriented Language (COBOL) Programming Language Committee. It is an official report documenting the development activities of CODASYL through July 1968. Author

N69-35798# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.

CONTEMPTS-PS: A DIGITAL COMPUTER CODE FOR PREDICTING THE PRESSURE-TEMPERATURE HISTORY WITHIN A PRESSURE-SUPPRESSION CONTAINMENT VESSEL IN RESPONSE TO A LOSS-OF-COOLANT ACCIDENT

C. F. Carmichael and S. A. Marko Idaho Falls Natl. Reactor Testing Sta. Apr. 1969 74 p refs
(Contract AT(10-1)-205)
(IDO-17252) Avail: CFSTI

A complete description of the CONTEMPT-PS computer program, for prediction of the pressure-temperature history in a pressure suppression containment, is given. The pressure-containment system model is described; equations and method of solution are detailed. Complete input/output format is given; the program, itself, is listed. The program is written in FORTRAN IV with symbolic routines that convert BCD to binary, and it is written for the IBM 7040-44. A sample program is included. NSA

N69-35804# European Nuclear Energy Agency, Paris (France).

NEUDADA SYSTEM DESCRIPTION

J. Poetsch and N. Tubbs Apr. 1969 73 p refs
(CCDN/SYS-2) Avail: AEC Depository Libraries

The NEUDADA allows a wide range of neutron or other numerical data to be stored in a compact standard format and retrieved in direct access. It accepts input data according to the relatively restricted SCISRS 1 specifications, and allows retrieval in one of three special purpose output formats, while large data sets in formats other than SCISRS 1 are converted directly to the NEUDADA internal format by the generalized TONDADA conversion program. Keywords identifying data sets, comments and numerical data are organized in three files: a relatively short index similar to the CCDN's fourth Newsletter controls direct access to the larger comment and numerical data stores. The system is divided into programme modules of the size most suitable to the CCDN's small computer: this organization, and the use of a high-level language (PL/1) in conjunction with manufacturers' standard software, should make it possible to transfer the system to other modern computers with very little loss of efficiency. Author (NSA)

N69-35813*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.

REPORT ON THE USE OF ISAOPLOT

Richard Huber and Stephen Donnelly Mar. 1969 29 p refs
(Grant NGR-22-009-015)
(NASA-CR-105267; CSR-TR-69-11) Avail: CFSTI CSCL 09B

Program description and directions for use are presented for a FORTRAN procedure to produce Calcomp plots of selected portions of the celestial sphere. The brightest stars in the regions are chosen from two magnetic tapes that are rewritten versions of the Smithsonian Astrophysical Observatory's Star Catalog tapes. The stars are plotted in their correct positions relative to the center for a flat plate photograph and are indexed in a table containing further data on both plot and line printer. Positions of X-ray sources can be input and will be plotted and listed; and nearby stars, irrespective of magnitude, can also be found. In addition, a variable mesh grid of constant α and δ lines and a title may be specified. Stars may be selected by spectral type. In addition to the main program description, INTRP, a FORTRAN subroutine designed to translate the packed 7094 format of the original Smithsonian tapes to a format compatible with the 360, is also treated. A.C.R.

N69-35816*# Sperry Rand Corp., Huntsville, Ala. Space Support Div.

COMPUTER-AIDED FILTER DESIGN MANUAL

Sidney Gussow and Glenn Weathers Washington NASA 1969 106 p refs
(Contract NAS8-20055)
(NASA-SP-3049) Avail: CFSTI CSCL 09B

A computerized filter design procedure to provide a simplified and accurate method of design and synthesis for engineers having minimum experience in this area is described. It may also be utilized by experienced personnel to perform laborious and complex calculations. The procedure consists of selection, analysis and synthesis of electric wave filters for telemetry applications. Filter selection includes the use of charts to assist in rapid choice of a suitable configuration. Passive synthesis programs calculate the component circuit values required for the specific filter; use realization techniques for singly and doubly loaded networks, and assist the designer in tuning. Active synthesis is accomplished through active quadratic networks which are connected in cascade, and it is reported that the active design is not satisfactorily accurate for narrow bandwidth requirements or for a frequency much beyond 500 kHz. The analysis programs calculate filter response characteristics, including amplitude, phase, time delay, and group delay responses. A.C.R.

N69-35830*# Wyle Labs. Inc., Huntsville, Ala. Research Div.

DIGITAL COMPUTATION OF DOWNSTREAM MODES GENERATED BY THE INTERACTION OF A SHOCK WAVE WITH AN UPSTREAM FLOW CONTAINING THE THREE DISTURBANCE MODES (VORTICITY, ENTROPY AND SOUND)

D. M. Lister Mar. 1969 47 p refs
(Contract NAS8-21100)
(NASA-CR-105283; T.-69-1) Avail: CFSTI CSCL 09B

A FORTRAN computer program was written for the CDC 3300 which computes the values of the modes of the perturbed downstream flow field resulting from the interaction of an infinite, plane shock wave with an upstream flow containing perturbations in all three modes: vorticity, entropy and sound. Author

N69-35866# European Atomic Energy Community, Geel (Belgium). Joint Nuclear Research Center.

IBM 1800 UTILITY PROGRAMS FOR MAGNETIC TAPES AND TELE-PROCESSING INPUT/OUTPUT

H. Schmid and H. Claessens (IBM, Belgium). 1969 145 p refs
(EUR-4263.e) Avail: CFSTI

This report describes the following utility programs for the IBM 1800 computer: (1) magnetic tape utility programs to execute a tape dump, tape map and tape duplication for 7 and 9-track tapes; and (2) programs for a tele-processing system with magnetic tape terminals (IBM 7702) connecting the IBM 1800 system with the computers IBM 7090 and 360 (card input and output, list output and Calcomp plotter output). All programs are written in IBM 1800 ASSEMBLER language for the Time Sharing Executive System (TSX). Author

N69-35942# National Physical Lab., Teddington (England). Central Computer Unit.

SOAP: SIMPLIFY OBSCURE ALGOL PROGRAMS

R. S. Scowen, A. L. Hillman, and M. Shimell Apr. 1969 43 p refs
(NPL-CCU-6) Copyright. Avail: Issuing Activity

SOAP is a KDF9 Algol program which reads an Algol program as data, cleans it up, and outputs it in a form which displays its structure. Author (ESRO)

N69-35998# Joint Publications Research Service, Washington, D.C.
INFORMATION ROBOTS AND MANIPULATORS
G. P. Katys et al 27 Aug. 1969 38 p Transl. into ENGLISH from the book "Informatsionnye Roboty i Manipulyatory" USSR, Energiya Press, 1968
(JPRS-48698) Avail: CFSTI

An introductory survey is presented on the characteristics and applications of robot and manipulator systems. Subsystems such as power supply and control circuits are described. Structural and circuit diagrams are included. E.C.

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N69-34609# Pennsylvania Univ., Philadelphia. Moore School of Electrical Engineering.
CELLULAR ARRAY REALIZATION OF FINITE-STATE SEQUENTIAL MACHINES Final Technical Report
Jung-Chang Huang May 1969 134 p refs
(Contract DA-31-124-ARO(D)-97)
(AD-688623; Rept-69-23) Avail: CFSTI CSCL 9/5

A new type of fixed-cell, fixed-interconnection homogene cellular array that is capable of realizing any n-input, n-output combinational switching network is developed. The array is composed of identical combinational logic cells with three inputs and three outputs. The logic cells are arranged in a rectangular array with uniform interconnection structure. The signal flow is unilateral in vertical direction and bilateral in horizontal direction. Each n-column array is capable of realizing any set of n functions of n variables. The functional capabilities of the array can be changed by appropriately setting the parameters on the edges of the array. An algorithm for the realization of any give 2n-state sequential machine by using a single n-column array is presented. The theoretical work that leads to the synthesis of this array is also presented. Author (TAB)

N69-34623# California Univ., Livermore. Lawrence Radiation Lab.
REDESIGNED CONTROLS FOR THE ASTRON MAGNETIC FIELD USING OPERATIONAL AMPLIFIERS
Jerry W. Robinson 1 Apr. 1969 10 p refs Presented at Symp. on Eng. Probl. of Fusion Res., Los Alamos, N. Mex., 8 11 Apr. 1969 Sponsored by AEC
(UCRL-71567; CONF-690407-12) Avail: CFSTI

The Astron machine has undergone several stages of modifications. Each of these changes has required either increased flexibility or increased output from some subsystem. One of the more adaptable subsystems has been the voltage reference scheme used to control the shaping of the main solenoidal field. However a recent 70% increase in the required number of outputs, from 65 to 110, dictated a major expansion of the reference subsystem. Complete redesign and rebuilding proved to be more advantageous than expansion both in cost and system flexibility. Several factors leading to this conclusion and a description of the resulting system are presented. Author (NSA)

N69-34648# Deutsche Forschungsanstalt für Luft- und Raumfahrt, Brunswick (West Germany). Institut für Flugführung.
ELECTRONIC DISPLAY TECHNOLOGY AND ITS SIGNIFICANCE IN AIRCRAFT INSTRUMENTATION [DIE TECHNIK DER ELEKTRONISCHEN DISPLAYS UND IHRE BEDEUTUNG FUER DIE FLUGZEUGINSTRUMENTIERUNG]
R. Beyer *In* WGLR Proc. of the 5th WGLR Meeting on Human Factors Eng. Feb. 1968 p 7-36 refs In GERMAN (See N69-34647 20-05)
Avail: CFSTI

The conventional methods of aircraft instrumentation are compared to electronic display systems, the advantages concerning data reduction and adaptation to the human monitor are outlined. Display can be effected by analog or digital principles, and it is shown that digital principles are more advantageous owing to the fact that the image generator is capable of multiplexing between several display instruments. Quantitative and qualitative displays, head-up and head-down displays are discussed and future trends of development outlined. ESRO

N69-34673*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
PRELIMINARY PERFORMANCE OF A 1200 HERTZ ALTERNATOR, VOLTAGE REGULATOR, AND ELECTRONIC SPEED CONTROL OPERATING IN A BRAYTON CYCLE POWER SYSTEM
Sheldon J. Meyer and Robert C. Evans Aug. 1969 27 p refs
(NASA-TM-X-52645) Avail: CFSTI CSCL 09A

A single shaft turbine-compressor-alternator with electronic voltage and speed control was tested at approximately design turbine inlet temperature and speed with constant power output levels of 4.30, 5.02, and 6.08 kW. The purpose of this test was to check out the integrity of the design and the electrical component performance when operating in a Brayton cycle power generating system. All electrical components performed within design specifications although some aberrations were noted. The speed control introduced phase load unbalance. Load fluctuations were observed as each unit of the speed control began to apply load to the alternator. The fluctuations were small and did not result in changes of machine speed. The alternator armature windings operated with higher temperatures at 6 kW load than predicted. These temperatures are however within the design operating rating for the insulation on the windings. Author

N69-34681# Electrotechnical Lab., Tokyo (Japan).
RESEARCHES ON AN OPERATING RELIABILITY OF 10 KV THYRISTOR CONVERTOR
Tadao Sogawa, Takashi Horigome, Yoshikazu Kitani, Shinji Sawada, and Naotake Natori Jan. 1969 87 p refs In JAPANESE; ENGLISH summary *Its* Res. No. 697
Avail: CFSTI

Described are the details of the thyristor converter, the operating circuits and its structure for continuous operation, and the selection of quantities to be measured. Results of measurement of the leakage current and its variation in high temperature are described. Discussions are presented for stability and reliability of the control system of the converter. Integration of these results into designs for the convertor are also developed. The causes of occurring faults are given. Author

N69-34715# Dornier-Werke G.m.b.H., Munich (West Germany).
ELECTRONIC INSTRUMENTATION FOR VTOL AIRCRAFT

W. Bollinger *In its* Dornier-Post, No. 2-3, 1968 [1969] p 16-19 (See N69-34713 20-02)
Avail: CFSTI

Head-up and head-down display systems controlled by an on-board computer used to monitor the complex system of a V/STOL aircraft are discussed. Displays are used for flight director, hydraulic system and power plant control. ESRO

N69-34749# Lincoln Lab., Mass. Inst. of Tech., Lexington.
GRAPHICS Semiannual Technical Summary Report, 1 Jun.-30 Nov. 1968
Jack I. Raffel Nov. 1968 27 p refs
(Contract AF 19(628)-5167; ARPA Order 691)
(AD-679991; ESD-TR-68-350) Avail: CFSTI CSCL 9/2

A BCPL compiler is being transferred to the TX-2 from Project MAC. A microprogramming assembler has been written, and microcodes can be generated for a prototype processor under construction. The operation of the microcodes and the instruction sets they define can be simulated. An easily trainable public character recognition service has been made available to the TX-2 users community, and it can be called directly from leap programs. The mask design facility has been improved and used to generate artwork for several test circuits. In addition, development of an IBM 360 capability has continued to the point of real use by laboratory personnel. The AMBIT/G programming system has been refined in that drawn programs are themselves AMBIT/G data graphs. The waveform processing and RSP projects have been completed. The TIC testing terminal is being augmented with a small stand-alone computer. The logic design and simulation programs have been further developed to permit the input of data, observation of values, and generation of test sequences for the circuit under design. The conic display generator has had a major speed improvement, and storage scopes are being added to all TX-2 consoles. Author (TAB)

N69-34856*# Stanford Univ., Calif. Microwave Lab.
THE ANTENNA PROPERTIES OF OPTICAL HETERODYNE RECEIVERS
A. E. Siegman *In its* Study of Laser Freq. and Spectral Purity May 1969 8 p refs Repr. from Appl. Phys., v. 5, Oct. 1966 p 1588-1594 (See N69-34851 20-16)
(Contract DA-28-043-AMC-00446(E))
Copyright. Avail: CFSTI CSCL 09E

An optical heterodyne receiver is, in effect, both a receiver and an antenna. As an antenna it has an effective aperture or capture cross section $A_R(\Omega)$ for plane wave signals arriving from any direction Ω. The wavefront alignment between signal and local-oscillator (LO) beams required for effective optical heterodyning may be summarized in the antenna theorem $\int\int A_R(\Omega)d\Omega = [\eta^2/\eta^2]\ \lambda^2$ where the moments of the quantum efficiency η are evaluated over the photosensitive surface. Thus, an optical heterodyne having effective aperture A_R for signals arriving within a single main antenna lobe or field of view of solid angle Ω_R is limited by the constraint $A_R\Omega_R \approx \lambda^2$. Optical elements placed in the signal and/or LO beam paths can vary the trade-off between A_R and Ω_R but cannot change their product. Author

N69-34957# Sandia Corp., Albuquerque, N.Mex. Analytical Development Div.
STRUCTURAL CONSIDERATIONS IN ELECTRONIC MICROCIRCUIT LEAD WIRES
R. D. Krieg and W. B. Murfin Mar. 1969 22 p refs
(PB-183544; SC-DR-69-114) Avail: CFSTI CSCL 09A

The report gives a mathematical reason for the inherent strength in an acceleration environment and suggestions for reducing the stresses in a thermal environment. It is not meant to be an analysis but, rather, a guide to synthesis or design. The results are presented in a form which is meant to build intuitive insight into the consideration of miniature leads as structures. Author (USGRDR)

N69-34992 European Organization for Nuclear Research, Geneva (Switzerland).
THE SPARK-GAP SWITCHES OF THE NEW FAST BEAM EXTRACTION SYSTEM AT THE CERN PROTON SYNCHROTRON
L. Caris and E. M. Williams 23 May 1969 43 p refs
(CERN-69-13) Copyright. Avail: Issuing Activity

The performance of the spark gaps employed in the new pulse-forming system was studied through a million switching operations. The front and tail gaps operate under identical conditions and are considered mechanically and electrically similar. The pulses obtained with the front sparks contained ripples which are attributed to the current open feature design. The principle innovation in design is the concern with the reliability of operation over long periods. This has resulted in the system being less coaxial than earlier designs, resulting in waveforms deviating from the ideal square impulse. The most troublesome aspect of the operation of the front spark gap was reported to be the tendency for premature firing. Graphs of time jitter versus the normal operating range of the spark gap at different voltages are presented. F.O.S.

N69-34995# Joint Publications Research Service, Washington, D.C.
USING TRANSISTORS IN THE AVALANCHE MODE
V. D. D'Yekonov 7 Aug. 1969 8 p Transl. into ENGLISH from Radio (Moscow), May 1969 p50-53
(JPRS-48573) Avail: CFSTI

The nature of the avalanche mode and its special effects which are utilized by transistors are investigated. The basic shock ionization of a p-n junction and the motion of the current carriers through the junction is explained under conditions of increased voltage in the junction when energy levels impact on the atomic structure of electrons in the path of the carrier. Such atomic breakdown accounts for an abrupt, avalanche-like rise in the number of carriers and current flowing through the junction. Volt-ampere characteristics of transistors when impact ionization occurs are reviewed. Principal parameters of the avalanche range of seven transistors were studied; tabulated results are discussed. Examples of the diversity in systems based on avalanche-type transistors are included with circuit diagrams plus the operating characteristics of each system. M.H.E.

N69-35076*# Michigan Univ., Ann Arbor.
INTER-OBSERVER AGREEMENT AND MODELS OF MONAURAL AUDITORY PROCESSING IN DETECTION TASKS Final Report
Gordon Wells Wilcox (Ph.D. Thesis, Oct. 1968) Feb. 1969 121 p refs
(Grant NGR-23-005-159; ORA Proj. 07814)
(NASA-CR-86766; MMPP-68-4; Rept-07814-3-F) Avail: CFSTI CSCL 09E

The output of an electronic energy detector is correlated with the responses of human observers in monaural auditory detection tasks. An experiment showed that when the signal (pure tone) is present in the observation interval the correlation is greatest if the filter in the energy detector has a considerably narrower bandwidth than is necessary for maximum correlation when only noise is presented. The present study presents a quantitative development of the linear-uncertain model which is a generalization of the energy model. The form of the linear-uncertain model is

derived from the assumption that the observer is uncertain regarding the exact specification of the signal he is trying to detect. The decision variable of this model is the weighted sum of a linear function and a quadratic function of the input waveform. The relative weight of each component is determined by the observer's level of uncertainty regarding the signal. It is shown that the linear-uncertain model includes as special cases the linear, energy, and envelop models for auditory processing and like the filter-bank model can give an explanation of Ahumada's findings. Author

N69-35101# Joint Publications Research Service, Washington, D.C.
DEVELOPMENT OF ANTENNA ENGINEERING
B. V. Braude 12 Aug. 1969 14 p refs Transl. into ENGLISH of Radiotekhn. (Moscow), no. 6, 1969 p 1–11
(JPRS-48602) Avail: CFSTI

A brief historical sketch of the development of antenna engineering is reported. The purpose is to underscore the engineering progress in sophistication of approach to the various problem areas presented and the response by utilization of electrodynamic methods in their solution. The present time is associated with new methods applied to signal processing of individual complex-antenna components and technological proficiency in millimeter and optical wave ranges. A bibliography of 117 citations is incorporated within this presentation. M.H.E.

N69-35264# Forsvarets Forskningsanstalt, Stockholm (Sweden).
REGULATING CIRCUIT FOR MAINTAINING CONSTANT SPEED OF A ROTATING ANTENNA [REGLERKRETS FOER KONSTANTHALLNING AV ROTATIONSHASTIGHETEN HOS EN ANTENNVRIDARE]
R. Andemark Nov. 1967 30 p In SWEDISH
(FOA-2-C-2200-54(61)) Avail: CFSTI

This control circuit consists of a three-phase asynchronous motor, a control amplifier, a magnetic coupling with an inductive variocoupler, the antenna clutch, a gear mechanism, and a tachometer with a rectifier. The antenna clutch operates with constant load and constant braking moment, adjusted by the control circuit to allow for wind loads and air resistance acting on the antenna. Fluctuations in the rate of rotation are kept to 1% by the control device. Two alternative circuit arrangements are also described for further improvement of the control accuracy, but a weight penalty of up to 52 kg is then incurred. Transl. by K.W.

N69-35381*# Israel Program for Scientific Translations, Ltd., Jerusalem.
RADIATION OF AN EXPLODING WIRE IN VACUUM
E. K. Chekalin and V. S. Shumanov *In its* High-temp. Properties of Gases. Phys. Gas Dyn., Thermodyn. and Phys. of Combust. 1969 p 118–121 refs (See N69-35365 20-12)
Copyright. Avail: CFSTI CSCL 09E

Evaluated was the emission spectrum of an exploding wire in a vacuum. Photographs of the plasma cloud expansion radiating from the explosion showed that there was initially a spectrum with individually strongly broadened spectral lines of copper which formed into a continuous spectrum after 18 to 32 μsec at the moment when the glow zones inside the plasma cloud met. These glow zones were probably produced by electrode material flows. The existance of an absorption spectrum indicated that the flow intensity of the continuous spectrum was higher than the electron temperatures in the outer layers of the expanding plasma cloud. Thus, both the integrated radiation of the exploding wire plasma and its spectral districution were inhomoganous in time and space. G.G.

N69-35382*# Israel Program for Scientific Translations, Ltd., Jerusalem.
ELECTRIC CHARACTERISTICS OF AN EXPLODING WIRE IN VACUUM
E. K. Chekalin and V. S. Shumanov *In its* High-Temp. Properties of gases. Phys. Gas Dyn., Thermonyn. and Phys. of Combust. 1969 p 122–126 refs (See N69-35365 20-12)
Copyright: Avail: CFSTI CSCL 09E

Theoretical values and current-voltage oscillograms of exploding copper wires show that the variation with time of the discharge current is linear. After breakdown of the spark gap and ignition of the arc discharge in the metal vapor, current variation is determined by electric circuit parameters since resistance and inductance of the discharge interval are small. Initial voltage drop is determined by the ratios of wire resistances and inductances and of the whole circuit. A second voltage discontinuity is observed at the beginning of the evaporation, after which the wire resistance increased until the voltage gradient becomes sufficiently high to ignite an arc in the metal vapors. G.G.

N69-35383*# Israel Program for Scientific Translations, Ltd., Jerusalem.
DEFORMATION OF SOLIDS BY AN EXPLODING WIRE
V. F. Vygovskii, E. K. Chekalin, and V. S. Shumanov *In its* High-Temp. Properties of Gases. Phys. Gas Dyn., Thermodyn. and Phys. of Combust. 1969 p 127–128 refs (See N69-35365 20-12)
Copyright. Avail: CFSTI CSCL 09E

Electric wire explosions were used to fuse a pipe-ring joint for a copper tube. The pressure pulse formed by the exploding wire deformed the metal in a radial direction and welded the pipe with the ring so that very strong pipe rings were obtained. G.G.

N69-35390*# Israel Program for Scientific Translations, Ltd., Jerusalem.
A DELAY CIRCUIT FOR TRIGGERING SHOCK-TUBE RECORDING INSTRUMENTS, AUTOMATICALLY CONTROLLED BY THE SHOCK-WAVE VELOCITY
R. G. Nemkov *In its* High-temp. Properties of Gases. Phys. Gas Dyn., Thermodyn. and Phys. of Combust. 1969 p 171–174 refs (See N69-35365 20-12)
Copyright. Avail: CFSTI CSCL 09E

Described is a delay circuit with phantastron probes for triggering the pulse in shock tube operations. The delay of the phantastron is a linear function of its controlling voltage proportional to the passage time of the wave. A schematic diagram of the delay circuit is included. G.G.

N69-35494# General Electric Co. Ltd., Stanmore (England).
PROGRESS ON L-BAND AEROSAT TRANSPONDERS
P. N. Denbigh [1969] 6 p Presented at the 9th Brit. Interplanet. Soc. European Space Symp., London, 14–16 May 1969
Avail: CFSTI

This paper discusses the problems of an L-band transponder suitable for an aeronautical satellite, and describes the progress made by GEC-AEI (Electronics) in developing such a transponder. Author (ESRO)

N69-35534# Forsvarets Forskningsanstalt, Stockholm (Sweden).
ABSOLUTELY STABLE S-BAND TUNNEL DIODE AMPLIFIER WITHOUT CIRCUIT [ABSOLUT STABIL S-BANDS TUNNELDIODFOERSTAERKARE UTAN NEDLASTNINGSKRETS]
E. Berqvist Oct. 1967 37 p refs In SWEDISH
(FOA-3-C-3531-61) Avail: CFSTI

This circulator-type amplifier is designed to be stable despite the lack of a loading circuit. Mechanical and electrical data of the amplifier are given, and service life, temperature stability, and operational effectiveness are discussed. The device is used in the amplifier circuit of a microwave radar. Amplification is 18 db at 3 GHz, the bandwidth is 390 MHz, and the system noise factor is 5.5 db when adjusted for maximum amplification. The diode material is germanium. The amplifier is compared with earlier developed S-band amplifiers. Experiences concerning the conditions for exchanging diodes in amplifier circuits are stressed. Transl. by K.W.

N69-35542*# TRW Systems Group, Redondo Beach, Calif.
HIGH POWER L-BAND TRANSMITTER AND ULTRASTABLE OSCILLATOR FOR THE NAVSTAR SATELLITES
Edmund Jurkiewicz and A. J. Mallinckrodt Oct. 1968 66 p refs (Contract NAS12-539)
(NASA-CR-86150; TRW-08710-6021-R0-00) Avail: CFSTI CSCL 09E

A refinement of the transmitter is discussed along with two additional designs and a commercially available crystal oscillator which meets the NAVSTAR requirements. Of the two additional transmitter designs, one is a straightforward approach using an L-band TWT power amplifier and the other incorporates a solid state L-band power amplifier. This latter design promises to be the most attractive from all standpoints of design including reliability and dc-to-RF efficiency. Efficiency is expected to be greater than 30 percent. However, the design also contains an element of uncertainty since development depends on the availability of high-power integrated modules or chips. Work is now in progress on high power S-band modules. The first solid state design using state-of-the-art components is shown to be superior to a TWT design in all respects except dc-to-RF efficiency. An efficiency of 22 percent minimum is expected as compared to 28 percent minimum for the TWT. A crystal oscillator is available which has shown the capability to meet the stability requirements. Author

N69-35589 Centre National de la Recherche Scientifique, Toulouse (France). Laboratoire d'Automatisme et de ses Applications Spatiales.
RELIABILITY OF ELECTRONIC COMPONENTS AND SYSTEMS IN AEROSPACE ENVIRONMENTS [FIABILITE DES COMPOSANTS ET SYSTEMES ELECTRONIQUES EN AMBIANCE SPATIALE]
M. G. Giralt *In* CERTS Determination of Radiation Doses in Space 1968 p 207-228 In FRENCH; ENGLISH summary (See N69-35576 20-29)
Copyright. Avail: Issuing Activity

The problem of reliability is considered from the point of view of the evolution of parameters which are recognized as significant for the component or the system. The notion of failure is in these conditions connected to certain characteristic limit values of the system and to the mission which it is destined to fulfill. The estimation of the probable evolution of the characteristics of a device during the course of time depends on: (a) The functioning of the system (internal stresses); (b) Conditions imposed by the surroundings (environmental stresses); (c) The influence of these stresses on the relevant physical parameters; (d) The influence of these physical parameters on the electrical parameters of the system; (e) The influence of varying electrical parameters on the quantitative and qualitative behavior of the system. If the essential problem lies in the possibility of arriving at a deterministic estimation of the future behavior of the system, it is necessary to take into account the imperfections of the general mathematical model of the component, whether this has been obtained by an analytic method or by identification arising from experimental results, as well as the imperfect knowledge of the stresses. The evolution of the system can therefore be described by means of the three following types of behavior: (a) Random catastrophic failure; (b) Random continuous evolution; (c) Deterministic behavior. The determination of the optimal structure of a system can be dealt with from this point of view by using compensation circuits or using feedback to minimize the sensitivity coefficients. Author (ESRO)

N69-35595 Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
POTENTIAL SHIFTS OF IRRADIATED MOS TRANSISTORS [DERIVES DE TRANSISTORS MOS SOUS RADIATIONS]
P. Glotin and J. Bernard *In* CERTS Determination of Radiation Doses in Space 1968 p 307-328 refs In FRENCH; ENGLISH summary (See N69-35576 20-29)
Copyright Avail: Issuing Activity

MOS transistors offer a number of advantages in space utilization, e.g. small volume, low dissipated power. Furthermore, their relatively easy manufacture leads to the use of integrated circuits on a large scale. The MOS system may, however, change with time, especially under ionizing electron and X-ray irradiations. The manufacture and electrical characteristics of a MOS transistor are recalled in the first part and emphasis is placed on curves furnishing information about traps in the body of the silicon oxide, voltage characteristics, capacity curve, conductivity measurements. Radiation effects on semi-conductors and insulators are discussed in the second part. In the case of the MOS structure, two types of defects are generated by irradiation: (a) defects in the silicon dioxide bulk, resulting in an increase of the number of trapped positive charges in the oxide and therefore in a drift of the conduction threshold Vs voltage towards negative values; (b) defects created by the rupture of the crystal structure at the $Si\text{-}SiO_2$ interface resulting in an increase of the number of traps at a depth of several hundreds of Angström, an exchange of charge carriers by the tunnel effect between these traps and the semi-conductor being possible. It is shown experimentally how the polarization of the control electrode, the manufacturing process and the stabilization of the oxide play an important role in the Vs amplitude variation at a given integrated flux. Several theoretical models have been proposed to account for this evolution of the MOS structure. Common principles in these various representations are discussed and the hypothesis used for the model conceived by the LETI at Grenoble is developed. Finally, results obtained during irradiation tests of the D2 satellite telemetry coder are described. The evolution of the MOS transistor characteristics is shown, taking into account the limits of such a ground simulation. Author (ESRO)

N69-35596 Centre National d'Etudes des Télécommunications, Lannion (France).
INFLUENCE OF OPERATING CONDITIONS ON BEHAVIOR OF TRANSISTORS SUBMITTED TO IONIZING RADIATIONS [INFLUENCE DES CONDITIONS DE FONCTIONNEMENT SUR LA TENUE DES TRANSISTORS AUX RADIATIONS IONISANTES]
M. G. Pelous *In* CERTS Determination of Radiation Doses in Space 1968 p 329-340 In FRENCH; ENGLISH summary (See N69-35576 20-29)
Copyright. Avail: Issuing Activity

Many experiments have shown the leading part played by surface phenomena in the degradation of the current gain of planar transistors subjected to low radiation doses in space. A review of the hypotheses concerning these phenomena has been made stressing the consequence of irradiation conditions on operating voltage and especially temperature. The data required for the selection or evaluation of the variation of transistor gain under radiation is also given. Author (ESRO)

N69-35661# Fondazione Ugo Bordoni, Rome (Italy).
PHYSICAL CHARACTERIZATION OF THE NULLOR-MODEL OF THE TRANSISTOR
Giuseppe Martinelli 2 May 1968 14 p Presented at the Intern. Symp. on Network Theory, Belgrade, 4–7 Sep. 1968
Avail: CFSTI

The nullor-model of the transistor, recently introduced in the technical literature, was derived by electric equivalence. In the present paper, an attempt is presented to characterize this model from a physical point of view. The attempt is based on the noise properties of the transistor, that seems more closely related to the mechanism originating the transistor itself. Author (ESRO)

N69-35787# Army Electronics Command, Fort Monmouth, N.J.
THIN-FILM HYBRID MICROCIRCUIT WIDE-BAND NOISE GENERATOR
R. A. Reitmeyer, Jr., S. Firestone, and H. C. Frankel Apr. 1969 37 p refs
(AD-688883; ECOM-3119) Avail: CFSTI CSCL 14/2

The knowledge and experience gained through previous fabrication and evaluation of thin-film components in the Electronic Components Laboratory is applied to an electronic circuit known as a wideband amplitude noise generator. The thin-film noise generator illustrates how thin-film hybrid microcircuits are produced and indicates some of the thin-film microcircuit techniques and capabilities available to ECOM personnel (in-house). Relatively large value capacitors (.01 microfarads) and resistors (700 kiloohms) are achieved, on a common substrate, through the use of thin-film techniques. High parameter stability for the passive components is possible with a temperature annealing process. The problem of low, non-destructive, breakdown voltages, inherent in large area capacitors with thin dielectric materials, is overcome by application of a voltage pulse to the capacitors. This voltage application serves to remove incipient points of low breakdown strength by virtue of the self-healing property of thin-film capacitors with aluminum electrodes. Finally, frequency changes in the relaxation oscillator with ambient temperature changes are predicted by means of developed equations. Author (TAB)

N69-35833*# Rotors (Herbert C.) Associates, Inc., Plainview, N.Y.
BRUSHLESS dc MOTOR Final Report, 1 Apr. 1968–18 Apr. 1969
18 Apr. 1969 180 p Prepared for JPL
(Contracts NAS7-100; JPL-951463)
(NASA-CR-104086) Avail: CFSTI CSCL 09E

A small dc brushless motor is discussed with logic controlled semiconductor commutation power supply to provide reversibility and to include a speed control system. The objective is to explore the possibility of building such a motor in a 3/4" diameter × 1-1/4" length body. The work done covers the design development and testing of an engineering model including environmental tests. Performance tests were conducted for motor operation in continual run and in a stepping mode with pulsed inputs. The running performance of the motor agreed quite well with the calculated performance, producing maximum efficiencies in the region of 55% for the motor input only. The logic control power supply works and provides equally good performance in either direction. Operation of the motor by 1 millisecond pulses of voltage is not satisfactory because the mechanical steps resulting are erratic and dependent upon the starting position of the motor rotor. The motor speed control has not worked satisfactorily because of instability when the loop system is closed. Author

N69-35844 Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
CONTRIBUTION TO THE STUDY OF TIME-RESOLUTION IN PULSE ELECTRONICS FOR NUCLEAR PHYSICS: PHASE CONTROLLED CIRCUITS [CONTRIBUTION A L'ETUDE DE LA RESOLUTION EN TEMPS DE L'ELECTRONIQUE IMPULSIONNELLE POUR PHYSIQUE NUCLEAIRE: LES CIRCUITS DE MISE EN PHASE]
Jean-Paul Cortet (Ph.D. Thesis–Paris Univ.) Dec. 1968 120 p refs In FRENCH; ENGLISH summary
(CEA-R-3647) Avail: CFSTI

Phase controlled circuits make it possible to markedly improve the time resolution in pulse electronics. They replace a random pulse, of which the time of arrival with respect to a reference zero is being measured, by another pulse whose phase is well determined with respect to that of a clock taken as reference. The time spectrum of the output, delayed, can always be situated inside channels of width ΔT defined by the clock. The time statistics of the events analyzed is always correct even if the transition time for the circuits defining the channels represents a large fraction of ΔT: the coding of the time becomes perfect. The phase controlled circuits used in precision chronometry are widely applied in nuclear physics since the time spectra obtained are indirectly representative of certain values which need to be measured with great accuracy. A description is given of a) the constitution and operation of phase controlled circuits and b) a chain with automatic analysis and automatic reading for testing these circuits. The measurements are also discussed. Author (ESRO)

N69-35914# Joint Publications Research Service, Washington, D.C.
POSSIBILITY OF MEASURING THE RADIATION COEFFICIENTS OF RIGHT-ANGLE CRUCIFORM SLOT ANTENNAS WITH ALLOWANCE FOR THEIR RECIPROCAL EFFECT
Yu. V. Shubarin et al 19 Aug. 1969 8 p ref Transl. into ENGLISH from Radiotekhn. (Moscow), Jan. 1965 p 137–141
(JPRS-48643) Avail: CFSTI

The experimental determination of radiation coefficients taking into account the reciprocal effect is considered. The radiation coefficient was expressed in terms of the amplitude distribution in the system and ratio of the power losses to the power consumed at the antenna input. The power drop at the input and output of the antenna was measured by means of a polarization attenuator. The measurements were made frequencies of 9375 and 9272 megahertz. Author

N69-35966# Army Electronics Command, Fort Monmouth, N.J.
A LAMINAR SUBSIDIARY RESONANCE LIMITER
J. L. Carter, J. W. Mc Gowan, and S. Dixon, Jr. May 1969 23 p refs
(AD-688882; ECOM-3114) Avail: CFSTI CSCL 9/5

A laminar subsidiary resonance limiter that reduces the threshold power level for limiting by an order of magnitude was developed. The design was derived from a computer investigation of the effects of ferrite demagnetizing factors on threshold power level for ferromagnetic limiting. Minimum threshold power level is achieved when the demagnetizing factor in the direction of the applied dc biasing field is zero. This occurs only in a needle geometry. Multiple needles are required to provide sufficient ferromagnetic material for effective limiting. A laminar design consisting of alternate ferromagnetic and dielectric rods is used to obtain dc magnetic field isolation between the ferrite rods. This design gives the desired magnetic field demagnetizing factors while providing a dominant mode propagation path for the microwave signal. An X-band limiter was developed. It consists of 11 rectangular YIG rods separated by dielectric rods of the same dimensions and mounted

on the narrow side of RG-52 /U X-band waveguide. A combination of polycrystalline YIG and single-crystal YIG rods is used to increase the dynamic range of the limiter. The waveguide structure also effectively eliminates high-loss magnetostatic modes. The limiter has threshold power of 2.8 watts and a dynamic range of 30 dB. The insertion loss is less than 0.5 dB over the frequency range of 8.5 to 9.4 GHz. Author (TAB)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N69-35146# European Space Research Inst., Frascati (Italy).
DAMPING OF VOLTAGE REFLECTIONS AT OPEN CIRCUIT ENDS OF CHARGED CABLES
H.-J. Schneider-Muntau [1969] 15 p refs
Avail: CFSTI

Rectangular high-voltage pulses at capacitive loads, produced by charged cables, require a cable length that is determined by the pulse length. It is shown that the required cable length is only of the order of the pulse rise time, if the cable end opposite to the load is connected to a properly designed R-L-C circuit. This network serves to damp the voltage wave that is generated when the charged cable is connected to the capacitive load. The differential equations describing the characteristics of the reflected voltage wave in terms of the damping network are solved analytically. Author (ESRO)

N69-35151*# Auburn Univ., Ala. Electrical Engineering Dept.
PLASMA STUDY. RADIO FREQUENCY SYSTEMS. MILLIMETER WAVES STUDY Quarterly Report 1 Jun.–1 Sept. 1968
1 Sept. 1968 37 p refs
(NASA-CR-61828; QR-18) Avail: CFSTI CSCL 09C 09C

Axial current density measurements are made in an argon matnetoplasma column with a magnetic field length to radius ratio of 6 cm. By using a multi-ring composite anode, an instability in the plasma column is confirmed, and the critical field, B_c, is found to depend on the neutral gas pressure, p_g, in proportion to $P_g^{0.45}$. In all cases, a reversion back to a stable configuration is observed to begin when $B \leq 1.36\ B_c$. When $B < B_c$ the axial current density on the tube axis is observed to increase with increasing B_c indicating that modified Schottky theory must apply. Author

N69-35247# Fondazione Ugo Bordoni, Rome (Italy).
RECENT DEVELOPMENTS IN THE THEORY OF NETWORKS CONTAINING NEGATIVE RESISTANCES
Giuseppe Martinelli 20 Dec. 1967 44 p refs Presented at the Summer School on Circuit Theory, Prague, 28 Jun.–12 Jul. 1968
Avail: CFSTI

The advent of the tunnel diode and the possibility of having two-terminal negative resistances in readily usable form has made an important practical reality of the theory of linear lumped networks containing ideal negative resistances, which includes as a particular case the theory of negative-resistance amplifiers. The following topics are considered: 1) Determination of the linear equivalent circuit of a physical device, having a negative slope region of its static characteristic. The circuit must be equivalent to the device when biased to a point corresponding to the negative region and small-signal operated; 2) Realization procedures of negative-resistance devices of S and N types. The devices must have easily controllable static characteristics and be realized by transistors and resistors; 3) Stability of networks containing negative resistance as a function of the passive network embedding the active elements; 4) Effect of the variation of the values of the negative resistances on the behavior of an active resistance-terminated two-port with special regard to the case of low-pass high-gain amplifiers; 5) Noise performance of a resistance-terminated two-port as dependent on the noise of the negative resistance devices embedded in it. Author (ESRO)

N69-35327# Fondazione Ugo Bordoni, Rome (Italy).
AN ALGORITHM FOR THE SYNTHESIS OF MULTIPURPOSE LOGICAL DEVICE
Giuseppe Fantauzzi 17 Apr. 1968 25 p ref
Avail: CFSTI

This paper deals with the problem of synthesizing, with only one logical device, any set of functions of two variables. The result obtained is an algorithm which can be programmed on a computer. This algorithm makes it possible to obtain all the circuits with 3 or 4 inputs which perform the set of given functions. The results obtained by applying the algorithm are shown. Author (ESRO)

N69-35696# Royal Inst. of Tech., Stockholm (Sweden). Div. of Electron Physics.
PRESS SINTERED HEXABORIDE CATHODES Final Report
W. Wolski 24 May 1969 29 p refs Sponsored by UN
(Rept-69-12) Avail: CFSTI

The behavior of pressed sintered lanthanum hexaboride cathodes operating under conditions similar to those met in microtron accelerators are described. Yttrium and gadolinium hexaboride cathodes were also included in the investigation. Hot pressing cathode preparation and brazing methods are also described. The electron emission properties of the above materials were measured and the results are discussed. ESRO

N69-35944# Politecnico di Torino (Italy). Istituto di Macchine e Motori per Aeromobili.
ANALYSIS OF AN ELECTRONIC CONTROL SYSTEM FOR A DYNAMOMETER BRAKE SIMULATING INERTIA EFFECTS DURING ENGINE ACCELERATION [STUDIO DI UN SISTEMA ELECTTRONICO DI REGOLAZIONE PER FRENO DINAMOMETRICO AD INERZIA SIMULATA PER PROVE DI ACCELERAZIONE]
M. Andriano and A. Dadone Jun. 1967 45 p refs In ITALIAN; ENGLISH summary
(Publ-77) Avail: CFSTI

When simulating in laboratory conditions the road tests on car engines, especially acceleration tests, it is necessary to use a dynamometer brake able to simulate the inertia resistance of the car. In conventional brakes this is accomplished using a different set of flywheels for each car and each gear ratio. In this paper an adaptation of an existing electrical dynamometer brake is described in which the inertia resistance is simulated by appropriate control of braking torque, thus dispensing with the use of flywheels. The design and theoretical performances of the servomechanism necessary to accomplish this are described. The performances of the entire system have been controlled on an analog computer designed for this purpose. It is pointed out that the performances are at present somewhat limited by the electrical characteristics of brake used; a way to improve them further is outlined. In addition to being able to run acceleration tests of different combinations of engine/gearbox/car without any special adjustment, the electronic control system allows the brake to be used for tests at constant speed, constant torque or predetermined speed-power relationship (cubic law) with excellent results. Author (ESRO)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N69-34721# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CHARACTERISTICS AND POSSIBILITIES OF THE LARGE MODANE SONIC WIND-TUNNEL [CARACTERISTIQUES ET POSSIBILITES DE LA GRANDE SOUFFLERIE SONIQUE DE MODANE-AVRIEUX]
Marcel Pierre 1968 63 p refs In FRENCH; ENGLISH summary
(ONERA-NT-134) Avail: CFSTI

The characteristics of the 80,000 kW, 8-meter wind tunnel are discussed, as well as the various model installations and the numerous measuring devices, which are permanently developed and multiplied. The tests already carried out are examined. They are conventional aerodynamic measurements, motorized tests with the engines actually running or simulated by air jets, propeller, and rotor tests, canopy ejection, habitability without canopy, visibility in the rain, icing and deicing tests, etc. Author

N69-34805# Dornier-Werke G.m.b.H., Munich (West Germany).
VIBRATION EQUIPMENT IN THE ENVIRONMENTAL LABORATORY
In its Dornier-Post, No. 4, 1968 [1969] p 26-27 (See N69-34802 20-02)
Avail: CFSTI

A short description is given of a new vibration test stand, indicating the applicable load and frequency range. ESRO

N69-34806# Dornier-Werke G.m.b.H., Munich (West Germany).
MOVEMENT SIMULATOR FOR THERMAL CONTROL TESTS
E. Leschonsky *In its* Dornier-Post, No. 4, 1968 [1969] p 28-31 (See N69-34802 20-02)
Avail: CFSTI

A short description of a new two-axis satellite motion simulation for temperature control experiments to simulate pitch and spin is given, specifying design parameters of the mechanical system. ESRO

N69-34825# Federal Aviation Administration, Atlantic City, N.J. Dept. of Transportation.
EVALUATION OF UNITED STATES AIR FORCE PORTABLE AIRFIELD LIGHTING SYSTEM Final Report
Robert F. Gates Aug. 1969 43 p ref
(NA-69-33) Avail: Issuing Activity

An evaluation of a prototype portable airfield lighting system was conducted. Comparative tests were conducted using precision approach radar (PAR) in weather conditions of approximately 1/2-mile visibility. Motion picture film was taken of the segment ahead of the aircraft and the PAR scope was photographed three times a second to obtain data on approach light system effectiveness. The very limited weather data obtained in the six-week test period indicated that both systems would provide minimum acceptable visual guidance in 3/4-mile visibility conditions with the alternate approach light system preferred in 1/2-mile visibility conditions primarily due to the additional length of 900 feet. The runway edge lighting used in the portable approach light system provided adequate straight-in guidance, but circling guidance was inadequate for both day and night conditions. Several recommendations were made concerning the design of the brightness control, interlocking of systems through the console, and the method of supporting the approach and runway edge lighting fixtures. Author

N69-34956# Sandia Corp., Albuquerque, N.Mex.
HIGH TEMPERATURE FIXTURES FOR USE IN IMPACT STRESS STUDIES ON GAS GUN FACILITIES
Thomas L. Towne Nov. 1968 19 p refs
(PB-183113; SC-RR-68-831) Avail: CFSTI CSCL 14B

This paper describes several heating fixtures based on a common approach for use in uniaxial strain shock-loading experiments in solid material samples at temperatures up to 1300K. All of the fixtures are compatible with existing gas gun facilities, requiring no modifications to the guns for performance of high temperature experiments. Author (USGRDR)

N69-35011# Sandia Corp., Albuquerque, N.Mex.
IMPROVING TECHNIQUES FOR THERMAL CONDITIONS OF OBJECTS UNDER ENVIRONMENTAL TEST
Frederic T. Stixrud 9 Apr. 1969 9 p Sponsored by AEC
(PB-183541; SC-DC-69-1761) Avail: CFSTI CSCL 14B

Combined environment tests required some awkward combinations of facilities. It was proposed to enclose a test item completely within its mounting fixture and provides heating and cooling sources within the fixture. Experiments were made to determine the best methods of heating and cooling. Rate of change of temperature was investigated, as were temperature distribution and accuracy of control. Vibration and drop tests showed that test signatures could be transmitted with integrity. There are new and significant applications in the testing of miniature printed circuits and small precision mechanisms where clean room conditions must be maintained. Applications on shakers and drop tables are covered. Also illuminated are applications to thermal shock tests and production lines where radiation contamination is a problem. Author (USGRDR)

N69-35021# RAND Corp., Santa Monica.
SOME PROJECTED EFFECTS OF JET NOISE ON RESIDENTIAL PROPERTY NEAR LOS ANGELES INTERNATIONAL AIRPORT BY 1970
Paul T. Mc Clure Apr. 1969 167 p refs
(AD-688478; P-4083) Avail: CFSTI CSCL 1/5

Contents: The problem and definition of terms used; Review of the literature; Noise measurement; Property made uninhabitable by jet noise; Changing use of property made uninhabitable by jet noise; Paying the noise cost - revenue sources; Summary and conclusion. TAB

N69-35086# Cutler-Hammer, Inc., Deer Park, N.Y. AIL Div.
SEAL SYSTEM INTEGRATION Final Report
J. A. Lovell and B. Gold Jun. 1969 128 p ref
(Contract FA-67-WA-1654)
(SRDS-RD-69-6) Avail: Issuing Activity

A series of developments to provide for improved flight inspection of navigation aids based upon measurement of the individual parameters of a facility in a way that is independent of allied parameters and relatively free of error, are embodied in the

Signal Evaluation Airborne Laboratory (SEAL) system. The work in this report was to integrate and install developmental models of various recievers and subsystems in an aircraft to form this new flight inspection system, assist in its flight test, and reduce and report upon the flight test data. The SEAL system is to be used primarily for operational checks, site evaluation, commissioning, fault diagnosis, post accident investigation, post modification verification and periodic flight inspection. The different configurations and various equipments of the SEAL system are reported along with a description of the flight test program and an analysis of the various types of data collected. Author

N69-35114# Atmospheric Turbulence and Diffusion Lab., Oak Ridge, Tenn.

AN ECOLOGY-ORIENTED TELEMETERING SYSTEM

Walter M. Culkowski *In* Sandia Corp. Atmospheric Turbulence and Diffusion in the Planetary Boundary Layer May 1968 p 164–166 ref (See N69-35102 20-13)

Avail: CFSTI

As the obsolescence of the present telemetering system at Oak Ridge became increasingly apparent, a low-cost, extremely flexible replacement was selected compatible with existing equipment yet adaptable to the requirements of several weather-oriented disciplines. Through surplus, shortage, war, and financial difficulties the new system has and continues to have its merits as well as its troubles. Author

N69-35246*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

LOW GRAVITY FLUID MECHANICS DROP TOWER FACILITY

W. B. McAnelly and S. S. Covington 28 Feb. 1969 43 p refs

(NASA-TM-X-53817) Avail: CFSTI CSCL 14B

The George C. Marshall Space Center low-gravity simulating drop test facility is described. The design of the drag shield, test package, guide rails, stopping mechanism, control system and instrumentation are discussed. The operating characteristics and measured results obtained during operational check-out are reported. Problems encountered and future plans are described. Author

N69-35299# European Space Research and Technology Center, Noordwijk (Netherlands)

THE ACCELERATION ENVIRONMENT OF A SPACECRAFT AND ITS SIMULATION IN THE LABORATORY. SHOCK AND VIBRATION; PART 2 [L'ENVIRONMENT 'ACCELERATION' D'UN ENGIN SPATIAL ET SA SIMULATION EN LABORATOIRE. CHOCS ET VIBRATIONS. DEUXIEME PARTIE]

W. H. Johnson Jan. 1969 25 p Presented at the 6th ESRO Summer School, Noordwijk, Neth., 1968

(ESRO-TM-106) Avail: CFSTI

Laboratory acceleration testing does not in general consist of imitating the real environment. The latter is often statistically variable. Such tests would have no safety margin and little development value. Steady acceleration testing is done by either centrifuge or rocket track vehicle. The rotating nature of the centrifuge produces problems of coriolis forces, acceleration gradient along the arm, and tangential accelerations if a rapid acceleration build-up is required. Shock is a form of vibration, but is transient and typically has very short acceleration build-up time and very high peak value. Shock test machines normally use standard pulses (e.g. half-sine, sawtooth, rectangular, etc.) produced by methods ranging from passive arresting materials (e.g. lead) to complex spring/dashpot/compressed gas devices. Vibration during launch is one of the most important of the environments. Mechanical vibrators do not permit waveform control, therefore hydraulic (for thrusts up to hundreds of tons) or electrodynamic ones are used. These are force-producing and other forces fed-back from the test specimen necessitate *g*-controllers. The control equipment is particularly complicated for random vibration. Fixtures between vibrator and test specimen should have high natural frequencies, and test materials therefore have high values of the ratio modulus of elasticity/specific gravity. Many channels of acceleration measurement are often required during vibration test. Piezoelectric accelerometers and FM magnetic tape recording are almost universal. ESRO

N69-35359*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

USE OF A SIX-DEGREES-OF-FREEDOM MOTION SIMULATOR FOR VTOL HOVERING TASKS

Emmett B. Fry, Richard K. Greif, and Ronald M. Gerdes Washington Aug. 1969 26 p refs

(NASA-TN-D-5383) Avail: CFSTI CSCL 14B

A piloted, six degrees of freedom motion simulator has been evaluted with regard to its ability to simulate VTOL visual hovering tasks. Characteristics of the variable stability jet lift Bell X-14A aircraft were simulated, and results for the roll and pitch axes were compared with flight data. The roll axis data were also compared with data from two and single degree of freedom simulators. Control power and damping requirements for the roll and pitch axes compared very well with flight data. The simulator's motion quality was considered outstanding for VTOL hovering flight. Its travel limits were large enough to simulate hover/maneuver tasks on a one to one scale. Roll lateral motions (two degrees of freedom motions) gave essentially the same results as six degrees operation for evaluation of roll axis maneuvers. Author

N69-35422# Aeronautical Research Council (Gt. Brit.)

A FLIGHT SIMULATOR FOR RESEARCH INTO AIRCRAFT HANDLING CHARACTERISTICS

D. H. Perry, L. H. Warton, and C. E. Welbourn 1968 82 p refs Supersedes RAE-TR-66-373; ARC-29324

(ARC-R/M-3566; RAE-TR-66-373; ARC-29324) Copyright. Avail: CFSTI; HMSO: £1 6s 6d

The technical features of a piloted flight simulator, used in the study of aircraft handling qualities, are described. The equipment includes an analogue computer, several visual simulation systems using both direct optical and electronic techniques, and hydraulically driven motion systems for providing the pilot with acceleration cues. Some comments on the effectiveness of these devices for simulating piloted flight are included. Author (ESRO)

N69-35469# National Physical Lab., Teddington (England). Aerodynamics Div.

AN INVESTIGATION OF THE NOISE EXPOSURE DUE TO AIR AND GROUND OPERATIONS AT LONDON AIRPORT (HEATHROW)

W. C. Copeland and D. W. Robinson Dec. 1967 47 p refs

(NPL-AERO-SR-004) Copyright Avail: CFSTI

An outline procedure with tentative numerical values has been evolved for calculating, by simple summation of component noise exposures, noise exposure at a given position as a single value Q which is a composite measure of duration and noise level. The value of Q can be used as a basis for estimating risk of permanent hearing loss or for institution of hearing conservation measures. Author (ESRO)

N69-35581# Cologne Univ. (West Germany).
STUDY FOR A RADIATION CHEMISTRY RESEARCH CENTER [STUDIE UEBER EIN STRAHLENCHEMISCHES FORSCHUNGSTECHNIKUM]
C. Schneider and G. Ley Dec. 1968 22 p refs In GERMAN
(BMwF-FBK-68-47) Avail: AEC Depository Libraries

A study was prepared for a radiation chemistry research center which permits the development of radiation chemical processes from laboratory-scale to pilot plant-scale research as well as the training of scientific personnel. The overall planning which includes the technical complex, buildings for administration, laboratories, workshop, and store is discussed. Different design possibilities for the ^{60}Co source are given and radiation protection is taken into account. The costs for construction, radiation source, and equipment and the yearly operating budget are estimated. Author (NSA)

N69-35771# Simat, Helliesen and Eichner, Inc., Washington, D.C.
STUDY OF AIR CARGO AND AIR PASSENGER TERMINAL FACILITATION
Mar. 1969 240 p refs Prepared for the Dept. of Transportation
(PB-183226) Avail: CFSTI CSCL 15E

The current state-of-the-art and problems anticipated in the broad field of air cargo and air passenger terminal processing are presented. To achieve this objective the total concepts of air transport systems, facilities and ground handling processes have required identification and analyses. Since each function is a link in the total chain of events of air transportation, this report extends beyond the immediate areas of the facilitation aspects and highlights issues and problems of concern to other elements of DOT, Federal Departments and Agencies, air carrier industry, airport authorities and others. The publication is intended to serve as a guide for identification of problem areas and direction of coordinated planning efforts on all phases of the air terminal handling systems.
Author (USGRDR)

N69-35774# Chatham County-Savannah Metropolitan Planning Commission, Ga.
AIRPORT SYSTEM PLAN
Oct. 1968 33 p
(PB-183524) Avail: CFSTI CSCL 13B

The Airport System Plan is a recommended 1985 aviation system for Chatham County and Savannah, Georgia. The plan inventories present facilities and analyzes their deficiencies. It reviews the historical aviation activity and forecasts future activity in an effort to determine future aviation needs. The plan presents a long-range and short-range airport system and a method of implementation of each, based on the findings within the report.
Author (USGRDR)

N69-35815*# Melpar, Inc., Falls Church, Va.
APOLLO RECOVERY QUARANTINE EQUIPMENT Final Report
Jul. 1969 65 p
(Contract NAS9-6874)
(NASA-CR-101858) Avail: CFSTI CSCL 14B

The preliminary design concept, final configuration, and a description of the functional and structural components of the Mobile Quarantine Facilities (MFQ), for use in transporting astronauts from Apollo recovery zones to the Lunar Receiving Laboratory, are presented. The basic concept utilized a commercially available travel trailer as the primary structure to provide the required biological isolation immediately upon recovery and until transfer to the receiving laboratory. This approach was chosen in consideration of minimum production time and cost. The time factor was of particular significance, since the concept was developed prior to the Apollo launch pad fire which delayed the entire program schedule. The items delivered were four MFQ units, 35 transfer tunnels, and 90 biological isolation containers. The performance characteristics of the equipment as delivered are treated in detail, as well as the total design and fabrication effort involved in justifying certain design changes incorporated in the final product.
A.C.R.

N69-35827# European Space Research and Technology Center, Noordwijk (Netherlands).
THE ESRO IONOSPHERIC SOUNDING STATION AT CAPO SAN LORENZO, SARDINIA
G. E. N. Scoon Aug. 1968 38 p
(ESRO-TN-32-ESTEC) Avail: CFSTI

The purpose of this paper is to provide scientists and scientific groups who are engaged in ionospheric studies within the sphere of the Organisation's programme with detailed information on the operational characteristics and capabilities of the ESRO ionospheric sounding station, situated at Capo San Lorenzo on the Italian sounding rocket range at Salto di Quirra, Sardinia. A brief account is given of the agreement under which ESRO has been allowed to install and operate this station. A description is given of the station, including specifications of the equipment and antenna systems and its principles of operation. The capabilities of the ionosonde system are indicated. A note on the utilisation of the station, with illustrations of typical ionograms, is attached as an appendix.
Author (ESRO)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N69-34608# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ON A SOLUTION OF THE TURBULENT MIXING EQUATIONS WHEN THE TRANSFER FUNCTIONS PRESENT A SPATIAL SIMILARITY [SUR UNE SOLUTION DES EQUATIONS DU MEZANGE TURBULENT DANS LE CAS OU LES FONCTIONS DE TRANSFERT PRESENTENT UNE SIMILITUDE SPATIALE]
Roland Borghi (Ph.D. Thesis - Paris Univ., Paris) 1969 50 p refs In FRENCH; ENGLISH summary
(ONERA-NT-143) Avail: CFSTI

The so-called boundary layer equations are presented in a new way allowing the precise definition of the coefficients of mass, enthalpy and momentum turbulent transfer. Solutions in the von Mises plane (x, ψ), when these equations apply to the isobaric mixing of two co-axial jets, are then made possible by the definition of new parameters, a simple similarity assumption for them in the (x, ψ) plane, and the classical approximation $Pr \simeq 1$. The existence of solutions themselves also similar, is shown, when the initial conditions stay within a certain range; these solutions may be generalized when the Prandtl number is no more near unity, but stays constant along the $\psi = 0$ axis. The method is essentially theoretical and needs, to give practical results, to be confronted with several experiments.
Author

N69-34611*# National Aeronautics and Space Administration, Washington, D.C.
RADIATIVE HEAT EXCHANGE DURING FLOW OF A GAS THROUGH A TUBE

V. N. Vetlutskiy et al Aug. 1969 11 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Techn. Fiz. (Moscow), no. 5, 1968 p 82–88
(NASA-TT-F-12376) Avail: CFSTI CSCL 20D

The nonisothermal flow of a radiating real gas in a tube has been computed for the case of strong dependence of the absorption coefficient on the frequency. For a more complete description of the role of reabsorbed radiation, the flow of hydrogen under a pressure of 100 atm was examined. That radiation makes a significant contribution to the heat flux on the wall up to 9,000°K for a tube of radius 0.3 cm, and up to 6500°K for a tube of radius 3 cm is shown. The similarity of the temperature profiles in the two cases was observed for axis temperatures lower than 5,000°K. In a laminar flow of high-temperature gas, heat exchange occurs via conduction and radiation. Author

N69-34877*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EXPERIMENTAL STUDY OF THE RESPONSE OF A STATIC LIQUID-VAPOR INTERFACE AFTER A SUDDEN REDUCTION IN ACCELERATION
Leon J. Hastings 26 Jun. 1969 49 p refs
(NASA-TM-X-53841) Avail: CFSTI CSCL 20D

The behavior of a zero contact angle liquid–vapor interface after a sudden reduction in acceleration was experimentally investigated. The interface profiles and certain oscillation amplitudes were measured as a function of time and acceleration level using scale model S-4B liquid hydrogen and oxygen tanks. Based on the measured surface profiles, estimates were made of the time required for a surface to attain quasi-equilibrium. Author

N69-34700*# National Aeronautics and Space Administration, Washington, D.C.
STABILITY OF A LIQUID FILM ON THE SURFACE OF A ROTATING CYLINDER
L. N. Maurin Aug. 1969 4 p ref Transl. into ENGLISH from Zh. Prikl. Mekhan. i Techn. Fiz. (Moscow), no. 5, 1968 p 98–99
(NASA-TT-F-12377) Avail: CFSTI CSCL 20D

The article examines the stability of a thin layer of a viscous liquid held by forces of surface tension on the surface of an infinite rotating cylinder. It is shown that the cylindrical figure of the liquid layer is unstable under rotation, no matter how slow the latter is, with respect to long-wave annular axisymmetric disturbances. Author

N69-34709*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
NONEQUILIBRIUM GASDYNAMICS
William S. Watt Washington NASA Aug. 1969 39 p refs
(Contract NASr-109)
(NASA-CR-1411; CAL-AD-1689-A-10) Avail: CFSTI CSCL 20D

Theoretical and experimental studies of nonequilibrium phenomena pertinent to propulsion are reported. In particular, the emphasis was directed toward obtaining a better understanding of the chemistry, fluid mechanics and the coupling of these in hydrogen propulsion systems. Research has been concentrated in three areas: (1) development of a computer program for the numerical solution of nonequilibrium expansions of reacting gas mixtures and its application to recombination in rocket nozzles; (2) experimental studies of nonequilibrium phenomena in nozzle expansion flows; and (3) experimental studies of dissociation kinetics behind shock waves. While this research program was initially concerned with dissociation and recombination in hydrogen and the effect of catalytic additives on these phenomena, the techniques developed have been extended to investigate other nonequilibrium systems of interest in the propulsion and aerospace fields. Author

N69-34712*# Techtran Corp., Glen Burnie, Md.
EFFECT OF INCIDENCE AND REYNOLDS NUMBER ON HYPERSONIC FLOW PAST A CIRCULAR CONE [EFFET DE L'INCIDENCE ET DU NOMBRE DE REYNOLDS SUR L'ECOULEMENT HYPERSONIQUE AUTOUR D'UN CONE CIRCULAIRE]
Jacques Valensi et al Washington NASA Aug. 1969 21 p refs Transl. into ENGLISH from Rech. Aerospatiale (France), no. 128, Jan.–Feb. 1969 p 17–31
(Contract NASw-1695)
(NASA-TT-F-12401) Avail: CFSTI CSCL 20D

The flow around a 9° half-angle cone, held at incidence in a hypersonic blow-down wind tunnel (M_∞=7, Re_{∞} = 110,000/cm and 25,000/cm), was investigated. The shape of the bow shock was obtained from Pitot surveys. For low incidence it is a closed surface, but at high incidence this surface opens up. The intensity of the shock vanishes at the edges of the opening, whilst two vortices issue from the apex, the contours of which are given by the distribution of the stagnation pressure. Wall flow of the cone was studied visually, by means of static pressure, and convective heat transfer measurements. Separation occurred on the leeward side, even at an incidence much smaller than the half-angle of the cone. A theoretical evaluation of the convective heat transfer was made and compared with experiments. The boundary layer remains apparently laminar except at the highest Reynolds number, when transition gives rise to a turbulent reattachment. Author

N69-34812*# Pennsylvania Univ., Philadelphia. Inst. for Direct Energy Conversion.
PLASMA ENGINEERING
In its Inst. for Direct Energy Conversion Dec. 1968 13 p ref
(See N69-34810 20-06)
Avail: CFSTI CSCL 20D

Thermoelectric properties of barium-graphite compound synthesized by diffusion anneal are discussed. The lattice parameters of C_6Ba were determined by Debye-Sherrer techniques. The MHD flow in an annular gap, basic surface investigations, and a materials study of silicon solar cells are also reported. J.A.M.

N69-34929# United Kingdom Atomic Energy Authority, Wantage (England). Isotope Research Div.
CONSTANT-RATE-INJECTION AND VELOCITY METHODS OF FLOW MEASUREMENT FOR TESTING HYDRAULIC MACHINES
C. G. Clayton and G. V. Evans Dec. 1968 53 p refs
(AERE-R-5972) Avail: CFSTI; HMSO: 8s

The principles and operation of radiotracer methods of flow measurement, which are now established for use during turbine and pump efficiency tests, are described. Instructions are given for carrying out these measurements so that satisfactory results can be obtained, and an example is included of the method of calculating the results and of deriving the errors to 95% confidence limits. Author (NSA)

N69-34951*# Stanford Univ., Calif. Dept. of Mechanical Engineering.
THE TURBULENT BOUNDARY LAYER ON A POROUS PLATE: AN EXPERIMENTAL STUDY OF THE EFFECTS OF A FAVORABLE PRESSURE GRADIENT
H. L. Julien, W. M. Kays, and R. J. Moffat Apr. 1969 193 p refs
(Grant NGR-05-020-134)
(NASA-CR-104140; HMT-4) Avail: CFSTI CSCL 20D

Mean velocity profile data are reported for blown, unblown, and sucked accelerated boundary layers. Various pressure gradients

are investigated. The friction factor was found to be decreased by the imposed acceleration for suction, whereas for blowing an increase was indicated. Velocity profiles corresponding to these accelerated flows were found to deviate from those characteristic of zero pressure gradient flows. Semiempirical representations of these data in the form of simple Prandtl mixing length distributions are presented. The inner regions of the layer are represented by means of a two layer model and a continuous model. The outer regions are represented by an appropriate truncation of these distributions. Utilizing the resulting eddy diffusivity relations in a finite difference procedure, predictions of the present data were obtained. Agreement with the data is found to be acceptable for most engineering purposes. Author

N69-34987*# Stanford Univ., Calif. Dept. of Mechanical Engineering.

THE TURBULENT BOUNDARY LAYER: EXPERIMENTAL HEAT TRANSFER WITH BLOWING, SUCTION, AND FAVORABLE PRESSURE GRADIENT

W. H. Thielbahr, W. M. Kays, and R. J. Moffat Apr. 1969 184 p refs

(Grant NGR-05-020-134)

(NASA-CR-104141; HMT-5) Avail: CFSTI CSCL 20D

Surface heat-fluxes and mean temperature profiles in a turbulent boundary layer were measured along a porous flat plate in the presence of uniform transpiration (blowing or suction) and relatively strong favorable pressure gradients. The acceleration parameter, K, blowing fraction, F, and surface temperature were held constant. The range of boundary conditions achieved were: (1) $25 \leq U_\infty \leq 123$ ft/sec, (2) $-0.004 \leq F \leq +0.006$, (3) $-20 \leq (t_0 - t_\infty) \leq 43$°F, (4) $0 \leq K \leq 1.45 \times 10^{-6}$. These data apply to 2-dimensional, incompressible, turbulent boundary layers. The free stream and injected fluids were air. When supplemented with Julien's hydrodynamic data taken under the same flow conditions, the resulting data afford a unique opportunity to study both boundary layer developments relative to the local surface heat flux. Author

N69-35002# Aeronautical Research Associates of Princeton, Inc., N.J.

AN EXPERIMENTAL AND THEORETICAL INVESTIGATION OF THE INTERACTION OF A TURBULENT FREE SHEAR LAYER WITH THE REAR EDGE OF A HOLE

Ross Contiliano May 1969 77 p refs

(Contract Nonr-3903(00); ARPA Order-853)

(AD-688447; ARAP-130) Avail: CFSTI CSCL 20/4

The report presents the results of an investigation of the characteristics of the free jet which is formed within a cavity when an incompressible turbulent free shear layer impinges on the downstream edge of a hole. Experiments were performed in a subsonic wind tunnel using a cavity with variable hole geometry and impingement distance. Measurements of the stagnation pressure in the jet impingement region were used to determine the direction of the free jet relative to the original flow direction. In addition, the pressure measurements, supplemented by photographs of a cotton tuft plate, provided details of the geometry of the free jet at impingement. An equation was developed relating the turning angle of the flow, based on the center of the jet at the jet origin, to the ratio of hole thickness to shear layer thickness below the dividing streamline. The experimental data showed agreement with theory. An extension of the theory to the compressible case was developed. Author (TAB)

N69-35022# Massachusetts Inst. of Tech., Cambridge. Gas Turbine Lab.

A LIGHT SCATTERING INVESTIGATION OF DROPLET GROWTH IN NOZZLE CONDENSATION Final Report, Sep. 1966—Feb. 1969

Richard Roberts Feb. 1969 197 p refs

(Contract Nonr-3963(07))

(AD-688469; Rept-97) Avail: CFSTI CSCL 20/4

An experimental and theoretical study was made of the condensation of water vapor (with air carrier) in a supersonic nozzle in order to investigate the possible existence of condensate droplets which are substantially larger than predicted by the standard application of classical condensation theory. Droplet size was measured using light scattering techniques. It was found that approximately one part in 1000 of the droplet concentration reached a size a factor of 10 greater than predicted by the classical theory. The maximum droplet size, furthermore, was not seen to decrease proportionately as the nucleation zone was approached, indicating that the larger droplets are formed during the early stages of condensation. A calculation procedure which allowed the separation of the nuclei into a distribution of sizes resulted in the establishment of a qualitatively correct distribution shape but no theoretical substantiation of an aging or coarsening mechanism. A separate application of Brownian coagulation theory to surface-averaged condensation theory resulted in the predication that the average droplet size increased by a factor of between 2.5 and 4. No conclusion could be drawn concerning the actual existence of this size increase due to the level of uncertainty in the determination of average droplet size. Author (TAB)

N69-35069# California Univ., Berkeley. Div. of Aeronautical Sciences.

STUDY OF LAMINAR INCOMPRESSIBLE VISCOUS FLOW NEAR THE SHARP TRAILING EDGE

U. C. Paek Apr. 1969 92 p refs

(Nonr-222(45))

(AD-688431; AS-69-7) Avail: CFSTI CSCL 20/4

The region around the sharp corner in laminar viscous flow is studied for high Reynolds number. In order to avoid handling the full Navier-Stokes equations, the flow variables are expressed in the form of the asymptotic expansions, the first terms of which are solutions to separate local governing equations for each region. To reduce the computational details the Blasius boundary layer approaching the corner is approximated by a simple shear flow. The rotational inviscid flow region surrounding the corner becomes a well-posed boundary value problem for an elliptic partial differential equation. The thin viscous sub-layer, lying inside the rotational inviscid region, can be solved by Thwaites approximate method to calculate such parameters as skin friction and momentum thickness. In the immediate vicinity of the corner point Weinbaums theory is used to investigate the nature of the flow. Author (TAB)

N69-35108# Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.

CHARACTERISTICS OF DIFFUSION WITHIN MODEL CANOPIES

R. N. Meroney and J. E. Cermak *In* Sandia Corp. Atmospheric Turbulence and Diffusion in the Planetary Boundary Layer May 1968 p. 85—104 refs (See N69-35102 20-13)

Avail: CFSTI

A point source of an air-helium mixture was released continuously at various positions within a simulated canopy composed of 9 cm high pegs, 0.48 cm diameter, spaced in several arrays (2.54 × 2.54, 3.55 × 3.55, and 5.08 × 5.08 cm). Variations of the vertical location of the source revealed the strongly nonisotropic character of diffusion within the canopy with respect to the relative diffusion rates in the lateral and vertical directions. When the source was placed at various downstream distances from the

edge of the canopy, it displayed a tendency to exhale the plume near the front of the model canopy and to inhale the plume at distances further downstream. Calculations of the turbulent diffusion coefficient, K, within the canopy from the experimental data reveal a linear increase with height as suggested by previous authors. Author

N69-35153# National Physical Lab., Teddington (England). Ship Div.

VISCOUS EFFECTS ON SHIP STERN WAVES

G. E. Gadd Apr. 1969 8 p refs

(NPL-SHIP-132) Copyright. Avail: CFSTI

The waves emanating from the stern of a ship are usually much smaller than can be predicted by theoretical methods. This discrepancy may be due to viscous effects even in cases where no boundary layer separation takes place over the hull. A simple experiment in which frictional and potential-flow effects are separated to produce a situation where changes from an inversed flow wave pattern could be unequivocally attributed to friction was carried out and the results tend to support the above hypothesis. ESRO

N69-35172# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Fluid Mechanics Section.

APPROXIMATE INVERSION OF THE STREAM-TUBE-AREA RELATIONS

D. Ives Jul. 1969 7 p refs

(RM-452) Avail: CFSTI

In the calculation of compressible flows (such as the flow over high speed aircraft, in nozzles, or in inlets), it is often necessary to solve for the unknown flow velocity in terms of the known mass-flow. In the past, this solution had to be obtained either by time consuming iteration or by referring to lengthy charts or tables. This memorandum presents a simple, approximate solution that is rapidly calculated, very accurate, and requires little storage when implemented in a computer program. The proper use of this basic approximation may be the deciding factor between success and failure in practical compressible flow calculations. Author

N69-35178# Oxford Univ. (England). Dept. of Engineering Science.

A SURVEY OF HYPERSONIC NEAR WAKE STUDIES

R. I. Crane Aug. 1968 44 p refs

(REPT-1060-68) Avail: CFSTI

Published work on the fluid mechanics of the near wakes behind hypersonic vehicles is reviewed in this report. Emphasis is placed on laminar slender-body wakes, and the survey is chiefly concerned with theoretical treatments, though brief outlines of relevant experimental investigations are given. Author (ESRO)

N69-35248# Oxford Univ. (England). Dept. of Engineering Science.

TEMPERATURE DISTRIBUTION IN A THIN RECTANGULAR PLATE SURROUNDED BY FLUIDS

Richard N. Schneider Mar. 1967 20 p refs

(REPT-1026-67) Avail: CFSTI

An analytical solution is derived which describes the temperature distribution in a thin rectangular plate over which fluids are flowing. Variation of the local convective film coefficient, due to boundary layer growth in the direction of fluid motion, is included in the analysis. The solution describes both transient and steady state conditions, and can accommodate two different fluids simultaneously on the different surfaces of the plate. The flow direction of the fluids are independent of each other and are normal to any of the edges of the rectangular plate. Author (ESRO)

N69-35288# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

GAS TRANSPORT THROUGH POROUS MEDIA (SUR LE TRANSPORT DES GAS A TRAVERS DES MILIEUX POREUX)

Jean-Paul Breton (Ph.D. Thesis--Paris Univ., 20 Jun. 1968) May 1969 234 p refs In FRENCH; ENGLISH summary

(CEA-R-3553) Avail: CFSTI

In the first part of this report a rigorous transport theory for a mixture of gases passing through a bed of spheres is derived for the case of uniform temperature. The Boltzmann equation is solved by introducing boundary conditions in the solution. Two different methods are used, according to the nature of the flow. The second part deals with experimental work on permeability separation and interdiffusion. In the last part, the new theory is used to account for all the experimental data. Author (ESRO)

N69-35323# United Kingdom Atomic Energy Authority, Harwell (England). Chemical Engineering Div.

MEASUREMENT OF LIQUID FILM FLOW RATES AT 1000 PSIA IN UPWARD STEAM WATER FLOW IN A VERTICAL HEATED TUBE

A. W. Bennett, G. F. Hewitt, H. A. Kearsey, R. K. F. Keeys, and R. A. Stinchcombe Jan. 1969 12 p refs

(AERE-R-5809) Avail: CFSTI; UK 2s 6d

The flowrate of the liquid film flowing on the inside wall of a vertical 0.497 in. dia heated tube was measured at 1,000 psia for mass velocities of 2, 1.5 and 1×10^6 lb/hr.ft^2. The results show that as the burnout heat flux is approached the liquid film flow rate decreases smoothly, apparently towards zero at the burnout point at the mass velocities 1 and 1.5×10^6, and towards a very small value at the mass velocity of 2×10^6. Author (NSA)

N69-35365*# Israel Program for Scientific Translations, Ltd., Jerusalem.

HIGH-TEMPERATURE PROPERTIES OF GASES. PHYSICAL GAS DYNAMICS, THERMODYNAMICS, AND PHYSICS OF COMBUSTION

A. S. Predvoditelev, ed. 1969 214 p refs Transl. into ENGLISH of the Book "Svoistva Gazov Pri Vysokikh Temperaturskh: Fizicheskaya Gazodinamika, Termodinamika i Fizika Goreniya" Moskva, Izd. Nauka, 1967

(NASA-TT-F-558) Copyright. Avail: CFSTI CSCL 20D

Theoretical and experimental studies of gas flow properties at high tempratures, their thermodynamic functions and physicochemical processes are presented. Experimental results regarding the ionization and dissociation of gases and the properties of ionized gases in magnetic fields are included. For individual titles, see N69-35365 through N69-35395.

N69-35366*# Israel Program for Scientific Translations, Ltd., Jerusalem.

EFFECT OF SPHERICAL CONDUCTING FOREIGN PARTICLES ON THE ELECTRICAL CONDUCTIVITY OF GASES

E. V. Samuilov *In its* High-Temp. Properties of Gases, Phys. Gas Dyn., Thermodyn., and Phys. of Combust. 1969 p 1-13 refs (See N69-35365 20-12)

Copyright. Avail: CFSTI CSCL 12D

Conducting particles of small radius can be contained as natural impurities in the products of combustion of a solid or gaseous fuel, in high-temperature gas flows interacting destructively with surfaces. Particles are sometimes introduced artificially in the gas to increase its electrical conductivity. The particles affect the conductivity of the gases as a result of thermal ionization (a

considerable admixture of electrons is formed in the gas) and the effect of free electrons on the diffusion process. It is assumed in what follows that the radius R of the particles is considerably smaller than the average distance between electrons, ions, and charged particles. Author

N69-35369*# Israel Program for Scientific Translations, Ltd., Jerusalem.

INTERACTION POTENTIAL OF CO MOLECULES

N. N. Tsitelauri *In its* High-Temp. Properties of Gases. Phys. Gas Dyn., Thermodyn., and Phys. of Combust. 1969 p 28–32 refs (See N69-35365 20-12)

Copyright. Avail: CFSTI CSCL 20D

The kinetic theory of rarefied gases is used to calculate transfer coefficients of CO molecules if the intermolecular forces are known. Studied is the vibrational relaxation in CO behind a shock wave by obtaining the parameters of the interaction potential from relaxation time measurements and by using classical and quantum mechanical calculations to eliminate the effect of impurities on the time value of vibrational relaxation. Results show that the largest vibrational contribution is made by those collisions for which the axes of the molecules are arranged along the same line. G.G.

N69-35370*# Israel Program for Scientific Translations, Ltd., Jerusalem.

PARAMETERS OF CARBON DIOXIDE AND NITROGEN BEHIND SHOCK WAVES INTERACTING WITH A WEDGE

L. G. Gvozdeva and O. A. Predvoditeleva *In its* High-Temp. Properties of Gases. Phys. Gas Dyn., Thermodyn. and Phys. of Combust. 1969 p 33–50 refs (See N69-35365 20-12)

Copyright. Avail: CFSTI CSCL 20D

The gas-dynamic quantities behind shock wave, propagating in a gas with initial temperatures of 300–3000°K, have been tabulated for calculating different shock configurations generated during the flow of shock waves past a wedge. The interaction of the shock wave with a wedge consists in a reflected wave from the wedge surface and the flow of hot gas past the wedge behind the incident shock wave. This pattern depends substantially on the extent of the physicochemical transformations in the heated gas. The positioning of the reflected wave in the Mach configuration and the angle of inclination of the attached wave at the wedge are sensitive functions of the state of the gas in the regions bounded by these waves. Studies of the Mach configuration and the attached waves reveal regions in which double Mach configurations can exist. Investigations were undertaken for carbon dioxide and nitrogen. In the range considered the physicochemical transformations in these gases affect the gas parameters considerably. Author

N69-35372*# Israel Program for Scientific Translations, Ltd., Jerusalem.

STUDY OF THE FLOW STATE BEHIND A SHOCK FRONT BY MEANS OF FRAME-SCAN PHOTOGRAPHY

I. M. Naboko and R. G. Nemkov *In its* High-Temp. Properties of Gases. Phys. Gas Dyn., Thermodyn. and Phys. of Combust. 1969 p 59–63 refs (See N69-35365 20-12)

Copyright. Avail: CFSTI CSCL 20D

The state of the flow behind a shock wave was estimated from the angle made by the Mach line leaving the leading edge of the half-wedge, located in the section of the shock tube under consideration. The position of the Mach line was recorded by a series of still photographs. In addition to the still photographs, the flow may be easily recorded by frame-scan photography. The Schlieren frame-scan photograph of the flow past an obstacle and the propagation velocity of the weak disturbance (the sound velocity) in addition to measurements of the angle made by the Mach line with the flow axis show that behind the shock front in CO_2 the angle of inclination of the Mach line has a variable component generated as the boundary layer thickens. In nitrogen such periodical variations of the Mach number are almost absent. The average state of the CO_2 flow is close to the frozen state of the asymmetric valent vibrations of the molecules and the lag of dissociation. G.G.

N69-35373*# Israel Program for Scientific Translations, Ltd., Jerusalem.

EFFECTIVE PROFILE OF THE MACH LINE IN A RELAXING GAS

R. G. Nemkov *In its* High-Temp. Properties of Gases. Phys. Gas Dyn., Thermodyn. and Phys. of Combust. 1969 p 64–70 refs (See N69-35365 20-12)

Copyright. Avail: CFSTI CSCL 20D

The linear acoustic equation of a relaxing media is used to approximate the Mach line region in a relaxing gas. It is also established that in the cases where distances $(x,y) \to 0$ and $(x,y) \to \infty$ the structure of the disturbance region is such that a clearly expressed disturbance maximum exists localized along the frozen Mach line and correspondingly along the equilibrium Mach line. Author

N69-35377*# Israel Program for Scientific Translations, Ltd., Jerusalem.

FLOW STRUCTURE OF IONIZED GAS IN AN ELECTROMAGNETIC SHOCK TUBE

V. A. Bashilov and V. P. Shevelev *In its* High-Temp. Properties of Gases. Phys. Gas Dyn., Thermodyn. and Phys. of Combust. 1969 p 98–104 refs (See N69-35365 20-12)

Copyright. Avail: CFSTI CSCL 20D

A conic transparent chamber is used to study the formation of a plasma piston and plasma flow in an electromagnetic shock tube. Continuous photographic recording of the discharge indicate that at first a luminous band appears along the cone axis which broadens and fills up until a glow appears in the region behind the annular electrode. A pinch becomes then visible in the discharge chamber which revolves with constant angular velocity, starts to decrease, and at the end of the half-period of the discharge disintegrates completely. Photographs show that the plasma luminosity in the pinch is much greater than the luminosity in the surrounding medium; radiation intensity of the gas discharge plasma exceeds the luminosity of the shock heated gas. Studies of plasma flow past solids show that a supersonic plasma flow exists in the electric discharge shock tube. G.G.

N69-35389*# Israel Program for Scientific Translations, Ltd., Jerusalem.

THE BOUNDARY LAYER BEHIND A SHOCK WAVE IN ARGON AND NITROGEN

S. G. Zaitsev, E. V. Lazareva, and E. I. Chebotareva *In its* High-Temp. Properties of Gases. Phys. Gas Dyn., Thermodyn. and Phys. of Combust. 1969 p 160–170 refs (See N69-35365 20-12)

Copyright. Avail: CFSTI CSCL 20D

The boundary layer in the shock tube was studied with thin-film probes and interferometric methods. The results showed that at a certain distance from the shock front the heat fluxes increase sharply as a result of the transformation of the laminar boundary layer into a turbulent one. The interferometric method was used to determine the density distribution in the boundary layer, its thickness and rate of increase. The process can be better understood by measuring the density profile in the boundary layer

of different gases over a wide range of Mach numbers. In addition to the parameters ahead of the shock front, and then comparing these data with the values calculated under general assumptions. The experimental determination of the boundary-layer thickness and the density distribution in it for nitrogen and argon is also described. It is shown that for boundary layer Reynolds numbers below 1.1×10^6 and 0.3×10^6 for nitrogen and argon streams respectively, the variation of the boundary layer thickness agrees satisfactorily with the growth law of a fully laminar boundary layer. Author

N69-35440# Naval Civil Engineering Lab., Port Hueneme, Calif.
INVESTIGATION OF A BOUNDARY LAYER ATTENUATION SYSTEM. PART 1: LOW OVERPRESSURES Technical Report, Jul. 1967 – Jun. 1968
D. E. Williams May 1969 32 p refs
(AD-688419; NCEL-TR-R627) Avail: CFSTI CSCL 13/13

An air blast wave attenuation system for use with hardened structures and air entrainment systems was investigated, but analysis of the system which depends upon the relationship between choked flow and non-steady supersonic boundary layer formation is not so advanced that it can be completely described. However, an empirical confirmation is included and the feasibility of such an attenuator was verified experimentally. Results from shock tube experiments show that shock front attenuation increased nominally as the incident shock pressure was increased. In addition, significant attenuation was noted in the flow-field behind the shock front. Author (TAB)

N69-35444*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
AERODYNAMIC CHARACTERISTICS OF A PLATE AT AN ANGLE OF ATTACK IN A VISCOUS HYPERSONIC FLOW [AERODINAMICHESKIYE KHARAKTERISTIKI PLASTINY POD UGLOM ATAKI V VYAZKOMGIPERZVUKOVOM POTOKE]
V. S. Galkin Washington NASA Aug. 1969 10 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSR, Mekh. Zhidk. Gaza (Moscow), no. 1, 1969 p 59–63
(Contract NASw-1692)
(NASA-TT-F-12529) Avail: CFSTI CSCL 20D

Solution of the problem of a viscous hypersonic thermodynamically ideal gas flow incident on both sides of a horizontal flat plate at a zero or small angle of attack is demonstrated. A local self-similarity technique, based on a solution of a suitable set of equations for the boundary layers, is applied to the process. The overall aerodynamic characteristics of such plates are found by numerical integration of the rapidly varying local aerodynamic characteristics. Local-exponential interpolation of the integrands by trapezoids is performed in the course of the integration. Author

N69-35462*# Techtran Corp., Glen Burnie, Md.
CRITERION FOR DETERMINING THE BOUNDARY OF CONTINUUM FLOW IN A FREELY EXPANDING JET
A. L. Stasenko Washington NASA Aug. 1969 8 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (Moscow), v. 16, no. 1, 1969 p 9–14
(Contract NASw-1695)
(NASA-TT-F-12423) Avail: CFSTI CSCL 20D

Development of a criterion, based on the concepts of molecular mean free path and the modulus of the mean velocity of random motion, which makes it possible to obtain estimates of the position of the interface between continuum flow and molecular flow in the case of a steady jet expelled into a vacuum. The results obtained on the basis of this criterion for a spherical source are compared with those derived from a numerical solution of Boltzmann's kinetic equation and with experimental data. Author

N69-35477# Politecnico di Torino (Italy). Istituto di Macchine e Motori per Aeromobili.
UNSTEADY COMPRESSIBLE FLOW THROUGH DIAPHRAGMS AND ORIFICES [COMPORTAMENTO DI DIAFRAMMI ED ORIFIZI ATTRAVERSATI DA FLUIDO COMPRESSIBILE IN MOTO NON STAZIONARIO]
Andrea Dadone and Maurizio Pandolfi Dec. 1968 29 p refs In ITALIAN
(Publ-108) Avail: CFSTI

A theoretical model for the wave reflection and transmission of a compressible fluid moving through a perforated diaphragm is presented and discussed. It is shown that shocks propagated in an initially steady fluid only move at subsonic velocities. A theoretical evaluation and a set of experimental tests are discussed. ESRO

N69-35487# Fiat S.p.A., Turin (Italy).
STUDY OF CAVITATION PHENOMENA [ETUDE DES PHENOMENES DE CAVITATION] Final Report
C. P. Galotto, G. Mannone, M. Casali, and G. Artusio Brussels EURATOM Jul. 1969 83 p refs In FRENCH; ENGLISH summary
(Contract EURATOM-038-65-9 IRAI)
(EUR-4195.f) Avail: CFSTI

In this work cavitation phenomena have been studied systematically by means of a device which, combining the advantages of continuous and discontinuous systems for measuring cavitation damage, employs radioactive tracers to provide high measuring sensitivity. The rig consists basically of a closed loop into which the sample is inserted and then vibrated by an electrodynamic exciter. This device can be used to investigate cavitation as a function of the amplitude and frequency of the excited test-piece, to measure the damage produced by varying the temperature, speed, pressure and dissolved gas content of the cavitating liquid, and to measure the grain-sizes of the eroded particles in a simple manner. This process was successfully used to distinguish, under normal operating and transient conditions, the erosion strength of various materials in reproducible experimental conditions and to highlight the mechanical and physicochemical parameters that have a determining effect on cavitation. Author

N69-35519# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
UNSTEADY MOTION OF A SPHERE ALONG A CIRCULAR PATH IN A VISCOUS FLUID
Fuat Odar Mar. 1969 17 p refs
(AD-687279; CRREL-RR-255) Avail: CFSTI CSCL 20/4

Forces on a sphere moving unsteadily along a circular path in a viscous fluid are measured, and it is found that within the experimental range the formula valid for rectilinear motion has to be modified to account for the curvature of the path. Author (TAB)

N69-35552*# National Aeronautics and Space Administration, Washington, D.C.
THREE-DIMENSIONAL SUPERSONIC GAS FLOW ACCOMPANIED BY NONEQUILIBRIUM PROCESSES
O. N. Katskova et al Aug. 1969 18 p refs Transl. into ENGLISH from Zh. Vychislitelnoi Mat. i Mat. Fiz. (Moscow), v. 8, no. 5, 1968 p 1049–1062
(NASA-TT-F-12362) Avail: CFSTI CSCL 20D

A semicharacteristic scheme was developed for calculation of three dimensional supersonic equilibrium gas flow about a body located at the angle of attack. The application of this scheme both to blunted bodies and to bodies incorporating a channel of sufficiently smooth form has pointed to its efficiency. This semicharacteristic scheme was generalized to the case of three dimensional gas flows accompanied by nonequilibrium physical and chemical processes. The computational algorithms of this scheme are given in detail for such a case, in particular, to its application for numerical solution of supersonic flow of nonequilibrium dissociating oxygen in a nonaxisymmetric nozzle. Author

N69-35555# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Porz (West Germany). Institut für Angewandte Gasdynamik.

FLOW OF A CONDUCTING LIQUID IN CROSSED ELECTRIC AND MAGNETIC FIELDS [STROEMUNG EINER LEITENDEN FLUESSIGKEIT DURCH EIN GEKREUZTES ELEKTRISCHES UND MAGNETISCHES FELD]

G. Schweiger Apr. 1969 20 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-20; DVL-845) Avail: CFSTI

For the calculation of an incompressible, steady channel flow of a conducting liquid through crossed electric and magnetic fields a power series expansion is given. The region of validity for this expansion is defined. The first two terms for the pressure gain in this flow are calculated. The simplest case, a one-dimensional flow, is calculated more in detail. Author (ESRO)

N69-35604# Politecnico di Torino (Italy). Istituto. di Macchine e Motori per Aeromobili.

A METHOD FOR THE DETERMINATION OF RADIAL TURBINE PERFORMANCE [UN METODO PER LA DETERMINAZIONE DELLE PRESTAZIONI DI TURBINE RADIALI]

M. Pandolfi Assoc. Tec. Automobile Oct. 1967 37 p refs In ITALIAN *Its* Ric. ATA, Quaderno 14, Suppl. to No. 10
(Publ-85) Avail: CFSTI

A simple theoretical method for the off-design performance prediction of radial-inflow turbines is described starting from unidimensional flow, and adiabatic evolution and assuming that the incidence losses arise from the flow component orthogonal to the blade, the method can be used to the theoretical behavior of turbines and leads to interesting results. Torque variations as a function of the pressure and temperature of the gas are also discussed. ESRO

N69-35633*# National Aeronautics and Space Administration. Washington, D.C.

THE METHOD OF EFFECTIVE ENERGY IN THE PROBLEM OF A STRONG EXPLOSION IN A REAL GAS

V. V. Lunev Aug. 1969 6 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i. Fiz. (Moscow), no. 5, 1968 p 50–52
(NASA-TT-F-12375) Avail: CFSTI CSCL 20K

A method of calculating the effects of real gas properties in a high entropy layer in supersonic flow around thin blunted bodies is extended to the case of a strong explosion. Simultaneous equations are developed to determine the motion of the shock wave and the entropy distribution in the center of the explosion. A sample calculation is given for an explosion on the surface of the earth. N.E.N.

N69-35651# Forsvarets Forskningsanstalt, Stockholm (Sweden).

COMPARATIVE TEST WITH BISTABLE FLUID BOUNDARY LAYER ACCUMULATORS OPERATED BY AIR OR EXHAUST GAS PRESSURE [JAEMFOERANDE PROV PA BISTABIL GRAENSSKIKTSFLUIDISTOR MED TRYCKLUFT OCH KRUTGASFOERSOERJNING]

W. Sonered Nov. 1967 27 p In SWEDISH
(FOA-2-C-2210-54) Avail: CFSTI

Five different fluid amplifiers and switching elements of the boundary-layer type with a minimum jet inlet area of 14 mm^2 were developed and tested. The performance of these devices was compared with that of two other boundary-layer type fluid amplifiers designed for operation with exhaust gases at a temperature of 500°C or with compressed air. One of these devices was self-oscillating, the other was mechanically controlled. Temperature, pressure, expansion volume, and pressure pulses were measured for the various modes of operation. Transl. by K.W.

N69-35664# Oxford Univ. (England). Dept. of Engineering Science.

NUMERICAL SOLUTIONS OF HYPERSONIC NEAR WAKE FLOW BY THE PARTICLE-IN-CELL METHOD

R. I. Crane Aug. 1968 151 p refs
(REPT-1061-68) Avail: CFSTI

Theoretical solutions of near wake flow have been obtained by application of the particle-in-cell numerical technique to hypersonic flow over the base of a cylindrical afterbody. Using the inviscid equations of motion and a uniform upstream flow, the flow angle after separation was found to be much smaller than experimental slender-body results suggested. However, the inclusion of a vortical layer representative of a boundary layer on the body resulted in a realistic wake flow pattern, although the lack of true viscosity was apparent in the profiles of flow properties. It is concluded that satisfactory near wake solutions by this method might be obtained by the use of realistic viscosity terms throughout the flow field and of a much finer representation of the approaching boundary layer, but the required computing power would be presently impracticable. Author (ESRO)

N69-35679# California Univ., Livermore. Lawrence Radiation Lab.

EVALUATION OF EXPANSION CHAMBERS IN SHOCK-TUBE EXPERIMENTS WITH MASS ADDITION

Horst P. Richter 28 Apr. 1969 10 p refs
(UCRL-50823) Avail: CFSTI

In a previous evaluation of expansion chambers in shock-tube experiments the case of mass addition from the surrounding tube walls was not treated. The flow losses or frictional effects were calculated under the condition that mass did not enter or leave the system through the control surface. Relations are discussed which permit the determination of the amount of mass from the pipe walls that enters the flow of a hot gas. The usefulness of the relations is illustrated by applying them to a shock-tube experiment. These relations are critically compared with the true representation of measurements. Implications to theoretical calculations such as made in the PUFL code are mentioned. The use of the equations for predicting design criteria is outlined. It is again demonstrated that the concept of entropy is useful in the evaluation of measurements. Reference is made to the fact that entropy is also widely used in advanced theoretical calculations because it reduces mathematical complexity. Author (NSA)

N69-35709# Politecnico di Torino (Italy). Istituto di Macchine e Motori per Aeromobili.
CALCULATION OF THE STABILITY LIMIT OF THE OPERATION OF GAS TURBINES [SUL CALCOLO DEL LIMITE DI STABILITA DI FUNZIONAMENTO DELLE TURBINE A GAS]
Alberto Beccari and Leonello Verduzio Dec. 1968 30 p refs In ITALIAN; ENGLISH summary
(Publ-109) Avail: CFSTI

The purpose of this study was to investigate whether the phenomena occurring inside the combustion chamber of a gas turbine have any influence on its stability limits. Using the small perturbation method the stability limits of a hypothetical gas turbine were determined in the two cases the combustion process having and not having any influence on the behavior of the machine. The results show that the combustion chamber behavior has a very significant influence on the stability limits. Author (ESRO)

N69-35842*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NATURAL FREQUENCY OF LIQUIDS IN ANNULAR CYLINDERS UNDER LOW GRAVITATIONAL CONDITIONS
Thomas L. Labus Washington Sep. 1969 30 p refs
(NASA-TN-D-5412) Avail: CFSTI CSCL 20D

As a part of the general study of liquid behavior in a low gravity environment, an experimental investigation was conducted to determine the natural frequency of liquid sloshing in annular cylinders. Static contact angles were restricted to near zero degrees. The experiments were conducted over a range of gravitational conditions, including normal gravity, such that the bond numbers ranged from approximately 200. The natural frequency for deep liquid depths was empirically correlated with known system parameters as a function of the Bond number. Author

N69-35846# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.
SPECTRA OF INTERNAL WAVES AND TURBULENCE IN STRATIFIED FLUIDS. PART 2: EXPERIMENTS ON THE BREAKING OF INTERNAL WAVES IN A TWO-FLUID SYSTEM
J. Michael Hall and Yih-Ho Pao Jun. 1969 14 p refs Presented at the URSI/IUCRM Colloq. on Spectra of Meteorol. Variables, Stockholm, 9–19 Jun. 1969
(D1-82-0860) Avail: CFSTI

The breaking of internal waves on a sloping surface in a two-fluid system is studied experimentally in a wave tank. The characteristics of breaking internal waves are examined through their frequency spectra for cases of different frequency, amplitude, and wavelength. Wave height measurements are made with capacitance probes in conjunction with a recently developed capacitance bridge and are processed by computer utilizing the Cooley–Tukey fast Fourier transform algorithm. Spectra measured in the breaking region of the tank reveal a series of sharp peaks in the low frequency range representing the different harmonics of the internal waves. These higher modes, which possess little or no energy in the incident wave, gain energy at the expense of the lowest mode as the wave train propagates over the sloping surface. The result is a transfer of energy to higher frequencies through growth of the harmonics, each gaining energy at the expense of lower modes and transferring it to higher modes. At higher frequencies, the spectra no longer possess these distinct harmonics. The high frequency end of the spectrum in the breaking region has a slope of approximately –3 for all cases considered. Author

N69-35881# Hebrew Univ., Jerusalem (Israel). Microwave Div.
OPTICAL AND MICROWAVE MEASUREMENTS BEHIND SHOCK WAVES Progress Report, 1 Jun. – 31 Oct. 1968
William Low Nov. 1968 45 p refs
(Contract F61052-68-C-0037)
(AD-688894; PR-2; AFOSR-69-1457TR) Avail: CFSTI CSCL 20/4

The Mach velocity, shock tube attenuation and the maximum test time have been measured in two narrow shock tubes of 1 inch and 1/2 inch diameter. The apparatus is described. The results are compared with theories of Mirels, Roshko and Russel. The results are also compared with experimental results on large cross-sectional shock tubes. It is shown that for pressures of 5 Torr or less the narrow shock tube attenuation and maximum test time fits within a geometric scaling factor those of large cross-sectional tubes. At pressures of 10 Torr and higher partial turbulent flow can explain the experimental results. Author (TAB)

N69-35974# Centre National de la Recherche Scientifique, Meudon (France). Lab. d'Aérothermique.
CONTRIBUTION TO THE STUDY OF ISOTHERMAL MOVEMENTS OF WATER IN POROUS MEDIA [CONTRIBUTION A L'ETUDE DES MOUVEMENTS ISOTHERMES DE L'EAU DANS LES MILIEUX POREUX]
Ali Beighith May 1968 65 p refs In FRENCH
(Rept-69-1) Avail: CFSTI

A synthesis is presented of researches on water mass-transport in porous media. The general equation of hydraulic diffusion is set up taking into account the liquid as well as the gaseous phase. The effects of temperature on hydraulic diffusion is discussed and the part due to vapor diffusion is separated from the part due to liquid water diffusion. The experimental work was carried out in the hot climate of Tunisia. ESRO

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N69-34617*# Arizona Univ., Tucson.
TERRESTRIAL, LUNAR AND INTERPLANETARY ROCK FRAGMENTATION (SYNOPSIS)
William K. Hartmann *In its* Commun. of the Lunar and Planetary Lab., Vol. 8, Pt. 2 1969 p 75–79 refs (See N69-34613 20-30)
Avail: CFSTI

Connected data are presented on mass distributions of fragmented rocks. Mass distributions are typically power-law functions with exponent b; the b-values (slopes on log–log plots) increase as the samples are exposed to greater grinding and crushing or greater energy expenditure per particle. Plots of mass distributions can be used to interpret terrestrial and extraterrestrial rock samples. Author

N69-34880# Massachusetts Inst. of Tech., Cambridge. Instrumentation Lab.
OCEANIC TELESCOPE ENGINEERING PROGRAM REPORT ON PILOT PROJECT DESIGN, TESTING, AND PROGRESS THROUGH OCTOBER 1968
John M. Dahlen Oct. 1968 141 p refs
(Contract Nonr-3963(31))
(AD-679892; E-2320) Avail: CFSTI CSCL 8/10

The oceanic telescope is an array of sensors designed to observe internal waves at mid-ocean depths. This report describes the design of the telescope and the testing programs accomplished prior to its successful installation in the ocean off Bermuda. Author (TAB)

N69-34662# Miami Univ., Fla. Inst. of Marine Science.
VAISALA-BRUNT FREQUENCY AT AN ANCHOR STATION IN THE FLORIDA CURRENT
Joseph Paletta, Jr. and Saul Broida Oct. 1968 19 p refs
(Contract Nonr-4008(02))
(AD-680010; ML-68403) Avail: CFSTI CSCL 8/3

The Vaisala-Brunt frequency was investigated near the axis of the Florida current. Data from ninety-three std stations gives a complete profile of the Vaisala-Brunt frequency N versus depth for this region. Station profiles of N versus depth, a mean profile for the aggregate of stations, a plot of maximum N versus time, and the depth of N max versus time are presented. The standard deviation and variance were computed at three selected depths for N, and for the depth of N max. The average plot fo frequency versus depth is shown in Figure 4 and is representative of the Vaisala frequency in depth for this location. The depth at which maximum N occurs varies with time as does its magnitude; however, no apparent feature may be an important characteristic. Author (TAB)

N69-34668# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DETERMINATION OF LASA DETECTION AND LOCATION ABILITY USING KURILE ISLAND EVENTS
R. M. Sheppard, Jr. Oct. 1968 36 p refs
(Contract AF 19(628)-5167; ARPA Order 512)
(AD-678515; ESD-TR-68-325; TN-1968-23) Avail: CFSTI CSCL 08/11

The Kurile Islands ocean bottom seismographic experiment of late 1966 provided a source of epicenters for small regional and local events in a seismic region. Epicenters obtained from ocean bottom seismometer data and from the U.S. Coast and Geodetic Survey were used to evaluate the Montana Lasa epicenter location ability. Epicenters determined by plane wave approximation method gave mislocation errors, relative to the CGS locations, that averaged about 60 km. The same events were mislocated an average of 80 km when the epicenters were determined by a closely space grid of beams. Although the beam epicenter locations were worse than those of the plane wave method, the beam location method was able to produce epicenters for magnitudes well below the threshold of the plane wave method. The events in this experiment represent a sufficiently large population on which beam detection thresholds can be evaluated. The detection thresholds that were obtained confirm earliest predictions based on extrapolation from a single sensor. The detection results indicate that a 90-percent cumulative detection on a lasa beam will occur at about magnitudes 3.85 and 4.15 for a seismicity curve with a slope of 0.75 and 1.0, respectively. Author (TAB)

N69-34786# Royal Air Force, Farnborough (England). Inst. of Aviation Medicine.
INFORMATION ON MAPS FOR AIR AND GROUND USE
V. D. Hopkin *In* AGARD Pattern Recognition. Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 6 p (See N69-34751 29-04)
Avail: CFSTI

When a map is intended to be used in several operational roles, the problem of establishing optimum levels of detail for information on the map and optimum coding conventions for that information become difficult to solve satisfactorily. A trial sheet intended for air and ground use, is discussed, and some of the causes for the unfavorable comments of some potential users are indicated. An attempt is made to suggest probable changes in the appearance and content of the map which would have occurred if basic human factors principles had been applied in the early stages of its design. It is emphasized that such changes should not be accepted without empirical verification, and this process of applying basic principles is not a replacement for job analysis or user opinion. Author

N69-34781# California Univ., San Diego. Scripps Institution of Oceanography.
OBSERVATION OF HIGH FREQUENCY INTERNAL WAVES IN THE PACIFIC OCEAN Final Report
Robert L. Zelkan Sep. 1968 37 p refs
(Contract Nonr-2216(05))
(AD-679682; SIO-Ref-68-28; MPL-U-32/68) Avail: CFSTI CSCL 8/3

Observations of high frequency internal waves were made from 1 to 14 December 1966, in the deep sea off Baja, California. The fluctuations of the depth of an isotherm were measured with a three-element horizontal array attached to a stable platform. The waves are characterized as a broad band phenomenon with a continuous distribution in frequency. For short intervals of time, a narrow frequency band within the continuum is adequately described as a horizontally plane wave of a single vertical mode. Furthermore, this simplified structure is stationary over time spans of several days. High modes are present in the low frequency waves. Above 4 cycles per hour, however, the first mode predominates. The spectral shape is consistent with the shear limited equilibrium spectrum proposed by Phillips (1966). In addition, the predominance of the first mode at high frequencies further emphasizes the importance of shear instability in internal wave propagation. The horizontal properties of the wave field indicate well-defined directions of narrow-band propagation. These directions and the dispersive properties of the propagation have led to the identification of local topographic features in generating areas of internal waves. Author (TAB)

N69-34891*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
MAGNETOSPHERIC DUCT PROPAGATION RESEARCH USING ALOUETTE-2 TOPSIDE-SOUNDER OBSERVATIONS
Jayaram Ramasastry and Edward J. Walsh Washington Aug. 1969 75 p refs
(NASA-TN-D-5332) Avail: CFSTI CSCL 04A

This report presents a discussion of the intesne field-aligned propagation activity in the longitudes of Singapore observed by the Alouette-2 topside sounder. The frequency occurrence of sequences of ionograms containing conjugate echo traces is discussed in detail and attributed to the presence of field-aligned irregularities over a wide L-value range in the magnetosphere. Also described is the development of a unified model of field-aligned ducts in the magnetosphere from the analysis of the fine structure and diffuseness of the conjugate echo traces observed by the Alouette-2 sounder. The proposed model for the magnetospheric ducts is a large-scale, field-aligned, gaussian enhancement of electron density with a superimposed fine structure of small-scale gaussian ripples so that the large-scale variation has a ribbed rather than a smooth structure. Mathematical and digital ray-tracing analyses of the new model, along with illustrative ionograms which were used in postulating the model, are presented. Author

N69-34894# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
TRANSPORT PROCESSES IN OROGRAPHICALLY INDUCED GRAVITY WAVES AS INDICATED BY ATMOSPHERIC OZONE
James E. Lovill Feb. 1969 89 p refs *Its* Atmospheric Sci. Paper No. 135
(Contract AT(11-1)-1340; Grant ESSA-E10-68G)
(PB-183517) Avail: CFSTI CSCL 04A

A high performance sailplane equipped to measure ozone, temperature and vertical velocities studied a 125 sq km area simultaneous with the release of an ozonesonde and ESSA and NASA satellite observations. Theoretical scorer parameter computations compared favorably with actual aircraft measurements. Lee wave amplitude, wavelength and vertical velocities were determined by seven independent techniques. One technique used was to measure the structure of the lee wave from an ozone implied undulating flow pattern. Another was the measurement of the wave via satellite. Unique ozone sensor flow rate calibrations were also conducted during the study. Author (USGRDR)

N69-35016# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
COMPUTER MAPPING AND DATA PRESENTATION
H. T. McAdams Jan. 1969 116 p refs
(Contract DAHC04-67-C-0005; ARPA Order 841)
(AD-688672; CAL-VJ-2330-G-55) Avail: CFSTI CSCL 8/2

A general method is presented for evaluating environmental information in relation to its effect on the performance of ground-crawling vehicles and for mapping vehicle performance by computer methods. The suitability of the method for use with a variety of environmental inputs, as well as its general applicability to problems other than those of mobility, is indicated. Mobility is examined in terms of a driving force, an impedance and a flux, each appropriately defined in the context of ground-crawling vehicles and natural terrain. Performance is viewed as a point function of position coordinates in a mathematical field context, and statistical bases for aggregation of performance values are examined. Author (TAB)

N69-35051# Akademiya Nauk URSR, Kiev.
PHYSICAL PROPERTIES OF GEOLOGICAL ROCKS
1966 109 p refs In RUSSIAN *Its* Republican Interdepartmental Comm. Ser.: Theoret. and Exptl. Geophys., Issue 17
Avail: CFSTI

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6. ELASTIC PROPERTIES OF THE ALKALINE SYENITES OF THE OKTYABRSKI MASSIF A. Y. Diachkova et al p 81–85 refs (See N69-35057 20-13)
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N69-35052# Akademiya Nauk URSR, Kiev.
MAGNETIC PROPERTIES AND COMPOSITION OF SEDIMENTS OF THE EQUATORIAL ATLANTIC
T. S. Lebedev et al *In its* Phys. Properties of Geol. Rocks 1966 p 3–21 refs In RUSSIAN (See N69-35051 20-13)
Avail: CFSTI

Ocean bottom sediment samples were obtained in the western part of the equatorial zone in the Atlantic during a voyage of the research ship Mikhail Lomonosov in 1964. Samples for orientation purposes were obtained first and then selected and sorted. These samples were measured for their magnetic susceptibility and stability. The orientation samples were obtained by core drilling with tubular drills of o/i diameters 89/76 mm. Samples for laboratory analysis at the institute were obtained with core drills having o/i diameters of 127/115 mm. Standard geological inclinometers were used with the drills to vary the inclination. Locations and intervals of the drill stations are given. The samples, chiefly sand, silt, clay, mica, and marl, were analyzed for magnetic, thermomagnetic, endothermic, and physical properties. In addition to the magnetic measurements, the analytical methods included microphotography, electron microscopy, spectroscopy, chromatography, crystal-optical measurements, and X-ray analysis. Transl. by K.W.

N69-35053# Akademiya Nauk URSR, Kiev.
DETERMINATION OF ELASTIC WAVE PROPAGATION VELOCITY IN THE GRANITES OF THE UKRAINIAN SHIELD (AT A UNIFORM PRESSURE OF 1500 BAR)
D. V. Korniets *In its* Phys. Properties of Geol. Rocks 1966 p 22–34 refs In RUSSIAN (See N69-35051 20-13)
Avail: CFSTI

Experiments with large quantities of geological samples were conducted using a hydromechanical apparatus especially designed for these measurements. The apparatus permits fast measurements of elastic longitudinal waves with an accuracy of ±0.7% to 1.4%. It was established that the velocity of the elastic waves in granite samples of the Ukrainian shield varies with natural moisture content at this pressure by a factor of 5.1% to 8.5%. With the granite pre-heated to 110° to 130° C, velocity variations between 22% and 32% were observed. The findings verify the close relationship between velocity increases on the one hand and pressure, density, and porosity values on the other. The effects of ambient temperature were less important. A tendency toward great velocity increases was noted in samples having large pores and low density. Intensive velocity propagation occurs in granite to a depth of 1.0 to 1.5 km, while at depths down to 6.0 km the velocity increases at a magnitude gradient of 10 to 20 m/sec. km. Transl. by K.W.

N69-35054# Akademiya Nauk URSR, Kiev.
INVESTIGATION OF THE METASOMATIC VARIATIONS IN ROCKS ACCORDING TO THE MAGNETIC SUSCEPTIBILITY
M. I. Tolstoi et al *In its* Phys. Properties of Geol. Rocks 1966 p 35–44 refs In RUSSIAN (See N69-35051 20-13)
Avail: CFSTI

The magnetic susceptibility of geological samples was determined by assaying their mineral composition, structural characteristics, and tektonic processes. Parametric values were assigned for variations and for the statistical distribution of the

magnetic susceptibility in the samples. Susceptibility tendencies in the samples were found to be rather constant and strongly asymmetric. The most important factors responsible for magnetic susceptibility are content and distribution of ferromagnetic minerals in the samples. Some dependence of the metasomatic variation in the samples on the statistical distribution of the magnetic susceptibility was noted, and the values were observed to decrease with asymmetry and reduced content of ferromagnetic minerals. The application of the detected correlation between geochemical composition and physical properties to determine other geological characteristics is briefly discussed. Transl. by K.W.

N69-35055# Akademiya Nauk URSR, Kiev.
ELASTIC PROPERTIES OF THE METAMORPHIC ROCKS OF THE KRIVOY ROG BASIN
A. Y. Diachkova et al *In its* Phys. Properties of Geol. Rocks 1966 p 45–61 refs In RUSSIAN (See N69-35051 20-13)
Avail: CFSTI

Drillings and seismic soundings were performed to determine the elastic properties of the rock strata. In respect to their elastic properties, four main groups of rocks can be distinguished: hornstone, shale, meta-sandstone, and marble. Out of the large variety of mineral formations with different textural-structural properties that was encountered, the metamorphic rock series was characterized by an extremely high pitch variation of the elastic constant. Because of the velocity differences of vertical seismic soundings, it is easy to differentiate between hornstone and shale with their lower pitch on the one hand and meta-sandstone and marble on the other hand. The vertical wave velocity in connection with the Poisson coefficient were found to be excellent indicators for making this differentiation. The reliability of vertical seismic soundings becomes poorer with increasing depth, and the study of porosity as well as textural-structural properties assumes greater importance in that case. The soundings were conducted down to a depth of 1500 m. Transl. by K.W.

N69-35056# Akademiya Nauk URSR, Kiev.
PHYSICAL PROPERTIES AND COMPOSITION OF MAGMATIC FORMATIONS IN THE CENTRAL MOUNTAINOUS PART OF THE CRIMEA
T. S. Lebedev et al *In its* Phys. Properties of Geol. Rocks 1966 p 62–80 refs In RUSSIAN (See N69-35051 20-13)
Avail: CFSTI

This intrusive formation generally constitutes a solid massif throughout the central part of the mountainous Crimea following the zone from Krivoy Rog to Samsun. It includes deep faults characterized by significant changes in pitch during seismic soundings. Density variations were observed ranging from 2.62 to 2.80 g/cm^3 in rocks of medium suspension, with an average of 2.71 g/cm^3 as obtained from 2466 readings. Volumetric weight and magnetic susceptibility of the magnetic and sedimented metamorphic geological zones were specifically established for fine and medium crystalline gabbro-diorite, porphyritic gabbro-diorite, fine crystalline gabbro-diorite-porphyrite, porphyrite, and gabbro-diabase. For some of the samples, electrical resistivity, dielectric permeability, and vertical wave propagation velocity are specified. Transl. by K.W.

N69-35057# Akademiya Nauk URSR, Kiev.
ELASTIC PROPERTIES OF THE ALKALINE SYENITES OF THE OKTYABRSKI MASSIF
A. Y. Diachkova et al *In its* Phys. Properties of Geol. Rocks 1966 p 81–85 refs In RUSSIAN (See N69-35051 20-13)
Avail: CFSTI

Variations in seismic wave velocity, density, and modulus of elasticity were studied. Based on the materials examined in this study, it is concluded that only small differences exist in the elastic properties of the alkaline syenites. Two main factors were found to affect the elastic properties: the textural-structural homogeneity of the geological formation, and the quantitative composition of the mineral. A significant increase in seismic wave propagation, of the order of 5800 to 6000 m/sec, was found to occur in syenites of fine to medium texture, which are chiefly the dark-colored minerals. In spite of the relative uniformity of the elastic properties throughout the strata of the alkaline cyenites, it was possible to distinguish roughly between the various boundary lines. In general, the density of all strata of the syenites was identical, and no changes with depth were noted. Transl. by K.W.

N69-35058# Akademiya Nauk URSR, Kiev.
ON THE PRESSURE INSIDE THE SATELLITE MAGMATIC CHAMBER (USING THE CAPE PLUCK INTRUSION, MOUNTAINOUS CRIMEA, AS AN EXAMPLE)
Y. P. Orovetski *In its* Phys. Properties of Geol. Rocks 1966 p 86–90 refs In RUSSIAN (See N69-35051 20-13)
Avail: CFSTI

A proposal for an experimental study of pressure conditions inside this formation is outlined. The proposed experiment is designed to determine the depth of deposition of such large-scale intrusions in general in connection with hypsometric calculations. Distribution and formation of the intrusion, tectonic structure, and faults bounding the intrusion are briefly indicated by diagrams and preliminary calculations. Transl. by K.W.

N69-35059# Akademiya Nauk URSR, Kiev.
THE TIME OF RESTITUTION OF THE TEMPERATURE FIELD OF ROCKS DISARRANGED BY A BORE HOLE
V. V. Gordienko *In its* Phys. Properties of Geol. Rocks 1966 p 91–96 refs In RUSSIAN (See N69-35051 20-13)
Avail: CFSTI

The temperature gradients were calculated and compared with measurements in a large number of drill holes in the Ukraine. The measurements were performed at various depths down to a maximum of 3770 m. The time lapses between drilling and final measurement varied up to a maximum of 24 months. The results are shown in tables and then briefly discussed. Transl. by K.W.

N69-35071# Swiss Inst. of Meteorology, Zurich.
THE NEW RADIOSONDE STATION PAYERNE OF THE SWISS CENTRAL METEOROLOGICAL INSTITUTE [DIE NEUE RADIOSONDENSTATION PAYERNE DER SCHWEIZERISCHEN METEOROLOGISCHEN ZENTRALANSTALT]
P. Ackermann 1968 34 p refs In GERMAN; ENGLISH summary *Its* No. 12
Avail: CFSTI

A description of the new radiosounding station at Payerne is given. Since 1961 we improved continuously on our installations to satisfy the new severe stipulations of precision of measure and top height of sounding. Today, an entirely new and modern aerological station is established. Heights and winds are calculated automatically by a computer. Our radiosonde was greatly modified and gives satisfactory results. Next year a new model will be introduced to the service. A new system is supposed to measure the temperature at great heights. A new calibration chamber gives excellent results. Since five years a responder windfinding system with automatic antenna pursuit is being used. A further modification, allowing to make a complete radiosounding with only one man, is planned for 1969. Author

N69-35102# Sandia Corp., Albuquerque, N.Mex.
ATMOSPHERIC TURBULENCE AND DIFFUSION IN THE PLANETARY BOUNDARY LAYER. SYMPOSIUM ON THETHEORY AND MEASUREMENT
May 1968 267 p refs Symp. held in Albuquerque, N. Mex., 5-7 Dec. 1967 Sponsored by Sandia Corp. and White Sands Missile Range
(SC-M-68-191; CONF-671205) Avail: CFSTI

Conference proceedings focused on theoretical developments, experimental results, and wind tunnel studies and the instrumentation and techniques used in obtaining meteorological measurements for studying turbulence and diffusion For individual titles, see N69-35103 through N69-35122.

N69-35103# Meteorological Office (Gt. Brit.)
SOME OUTSTANDING ISSUES IN THE THEORY AND PRACTICE OF ESTIMATING DIFFUSION FROM SOURCES
F. Pasquill *In* Sandia Corp. Atmospheric Turbulence and Diffusion in the Planetary Boundary Layer May 1968 p 17-30 refs (See N69-35102 20-13)
Avail: CFSTI

The approaches used to represent the spreading action of a turbulent atmosphere are presented. Models, generalizations, predictions, and statistical analysis were used to explain the phenomenon. E.H.W.

N69-35104# Sandia Corp., Albuquerque, N.Mex.
TURBULENCE DATA FOR USE IN HAZARD ANALYSES
R. E. Luna *In its* Atmospheric Turbulence and Diffusion in the Planetary Boundary Layer May 1968 p 32-44 refs (See N69-35102 20-13)
Avail: CFSTI

Assessment of the hazard resulting from the random release of a dangerous aerosol to the atmosphere requires a model for predicting transport and turbulent diffusion of the aerosol and a statistical representation of the parameters which appear in the model. This paper presents the occurrence statistics of turbulence and wind speed parameters which appear in the generalized equations describing turbulent diffusion. The parameters, plotted in a log-probability format, are σ_A, the standard deviation of the wind direction, the product $\sigma_A U$ (where U is mean wind speed) and $\sigma_A{}^2 U$. The occurrence statistics are based on two years of wind speed and direction observations made at White Sands Missile Range and hence are only strictly applicable to that site. However, the data present a useful guideline for estimating magnitude and variability of these quantities at other sites where measurements accumulated over a comparable time span are not available. Author

N69-35105# Pennsylvania State Univ., University Park.
A SURVEY OF CURRENT THOUGHT ON WIND PROPERTIES RELEVANT FOR DIFFUSION IN THE LOWEST 100 m
Hans A. Panofsky *In* Sandia Corp. Atmospheric Turbulence and Diffusion in the Planetary Boundary Layer May 1968 p 47-58 refs (See N69-35102 20-13)
Avail: CFSTI

Diffusion in the atmosphere critically depends on the relative magnitude of production of mechanical turbulence and the production or destruction of turbulence by the temperature stratification. To support this, Richardson's number, eddy diffusion coefficients, similarity theory, and the spectra of velocity components are given. Also described are wind shear and lapse rate of atmospheric diffusion. E.H.W.

N69-35106# Battelle Memorial Inst., Richland, Wash. Pacific Northwest Lab.
MEASUREMENTS OF TURBULENCE IN THE LOWER ATMOSPHERE
Charles E. Elderkin *In* Sandia Corp. Atmospheric Turbulence and Diffusion in the Planetary Boundary Layer May 1968 p 59-73 refs (See N69-35102 20-13)
(Contract AT(45-1)-1830)
Avail: CFSTI

Measurements of turbulence in the three components of the wind were made at several heights up to 87 meters, in neutral, unstable, and stable conditions, and in a variety of wind speeds. The data were analyzed on an analog computer for power spectral density distributions, cospectral density distributions, and Reynolds' stresses. Similarity of the power spectral distributions was observed noticably for the vertical component, reasonably well in the longitudinal component, and least clearly for the lateral component. The spectra for the vertical component measured at 12 meters and above where bouyancy becomes effective, demonstrated definite convective energy peaks in unstable conditions. These occurred in addition to the mechanical energy peaks which corresponded in the normalized spectral distributions to those from the tests close to the ground where mechanical energy dominated the structure. The spectral function for the inertial subrange was detected consistently in the longitudinal and vertical component spectra but seldom within the frequency range of analysis for the lateral component. Author

N69-35107# Arizona Univ., Tucson. Numerical Analysis Lab.
ON THE PREDICTOR CORRECTOR SCHEME FOR THE DIGITAL SOLUTION OF THE PARTIAL DIFFERENTIAL EQUATION OF ATMOSPHERIC DIFFUSION
Edwin W. Titt *In* Sandia Corp. Atmospheric Turbulence and Diffusion in the Planetary Boundary Layer May 1968 p 75-84 refs (See N69-35102 20-13)
Avail: CFSTI

The purpose of this report is to extend the range and accuracy of our computer program for the predictor corrector solution of the partial differential equation of atmospheric diffusion from a line source. The problem is solved in slices proceeding in a downwind direction, each slice requiring a matrix reduction. The equations of the system are the integrated conditions of Green taken over vertical strips of elements. The original equation is written so that the linearized terms carry the main burden, giving a predictor so accurate that little iteration is required. In this report we introduce the idea of using two approximating nets when the demands of accuracy require a vertical step size too small for a stable process. One is a coarse net for the determination of the matrix and values of the solution at points of the fine net are computed from Green's formula in an overdetermined fashion using boundary values coming from the coarse solution. In turn, the fine results can be used to improve the accuracy of the corrector for the coarse solution. Author

N69-35108# Pennsylvania State Univ., University Park. Dept. of Meteorology.
EFFECT OF STABILITY ON THE WIND PROFILE UNDER CONDITIONS OF INHOMOGENEOUS TERRAIN ROUGHNESS
A. K. Blackadar, P. E. Glass, and H. A. Panofsky *In* Sandia Corp. Atmospheric Turbulence and Diffusion in the Planetary Boundary Layer May 1968 p 107-116 refs Presented at the AEC Micrometeorol. Inform. Meeting, Chalk River, Ontario, the week of 11 Sep. 1967 (See N69-35102 20-13)
Avail: CFSTI

For non-neutral conditions of stratification, a perturbation-type theory was developed to describe the effect of non-adiabatic lapse

rates on the depth of the accelerated layer. Under conditions of continuity of stress, wind speed, and wind shear at $z = \eta$, the equations of motion are integrated through the accelerated layer. From this integral an expression for $\partial\eta/\partial\alpha$ (where α is the reciprocal of the Monin length) as a function of downwind distance from the change in roughness is obtained. The results of preliminary tests of the theory indicate a somewhat smaller effect of stability than that predicted in a theory suggested by Miyake as modified by Panofsky (1965); both theories predict an increase of η with increasing instability, other factors being equal. However, the effect of stability on η is so small and the scatter in presently available observations is so large that it is not yet possible to discriminate between the two theories. Author

N69-35110# Argonne National Lab., Ill. Radiological Physics Div.

ON MEASURING VERTICAL FLUXES OF MOMENTUM AND HEAT W. H CUP ANEMOMETERS

Paul Frenzen *In* Sandia Corp. Atmospheric Turbulence and Diffusion in the Planetary Boundary Layer May 1968 p 118–124 refs (See N69-35102 20-13)

Avail: CFSTI

Simultaneous measurement of turbulence dissipation rates at two elevations is shown to be sufficient to determine the vertical momentum flux without appeal to either profile measurements or prior knowledge of surface roughness. It is also indicated that heat flux can be similarly evaluated, but in this application requirements of site uniformity and observation accuracy are more severe. Results of preliminary field trials in which dissipation values were derived from data recorded by fast-response cup anemometers are described. Author

N69-35117# Environmental Science Services Administration, Las Vegas, Nev. Air Resources Field Research Office.

A STUDY OF WIND VARIABILITY IN THE LOWER TROPOSPHERE THROUGH POWER SPECTRUM ANALYSIS AT MESOSCALE FREQUENCIES

John S. Cornett *In* Sandia Corp. Atmospheric Turbulence and Diffusion in the Planetary Boundary Layer May 1968 p 199–232 refs (see N69-35102 20-13)

Avail: CFSTI

This study provides an investigation of the wind variability produced by mesoscale perturbations. An attempt is made to relate these perturbations to known physical causes. The results are based on power spectrum analyses of wind data in the lower troposphere at Yucca Flat, Nevada and Cedar Hill, Texas. The data were obtained from a special 5-day series of radar-tracked balloon observations taken at 20-min intervals during the period from 27 January to 01 February, 1964. Simultaneous wind observations were also obtained from nearby Bren Tower at the 141-ft and 1500-ft levels. For comparative purposes wind observations were also obtained from Bren Tower and Cedar Hill tower during other observations periods. An inspection of the spectral analyses from the Bren Tower and balloon data at the same level indicated that upper-air observations may be used to obtain valid estimates of the wind spectrum at low frequencies. Physically real but minor peaks were found in the wind spectral band between .0625 and 15 cy hr^{-1} which are apparently associated with organized perturbation caused by the roughness of the terrain, cellular convection, and internal gravity waves. A comparison of the Bren Tower and Cedar Hill Tower direction spectra indicates good agreement in terms of well-defined maxima and minima between the two sites for frequencies from about .33 to 3 cy hr^{-1}. The power associated with the oscillations over the comparable frequency range differ considerably, however. The results seem to indicate that the physical phenomena responsible for the direction variance are common to both sides but differ in amplitude. Author

N69-35118# White Sands Missile Range, N.Mex. Atmospheric Sciences Lab.

A COMPARISON OF SIMULTANEOUS WIND PROFILES DERIVED FROM SMOOTH AND ROUGHENED SPHERES

Lawrence J. Rider and Manuel Armendariz *In* Sandia Corp. Atmospheric Turbulence and Diffusion in the Planetary Boundary Layer May 1968 p 233–239 (See N69-35102 20-13)

Avail: CFSTI

Wind profiles plotted from data obtained by tracking Jimspheres (rough surface) and smooth 100-gram spherical balloons released at a common point simultaneously are presented. High precision cinetheodolites were utilized to track the balloons. The computed wind shear for various thickness layers were greather when using data from the smooth balloon. The relationship between the magnitude of the mean vector shears and the shear interval (Δh) assumes a power law with the exponent varying from near one-fourth to two-thirds depending upon the sensitivity of sensor used and also the height above the surface. Author

N69-35119# Wisconsin Univ., Madison.

A NEW TURBULENT-TRANSFER THEORY BASED ON EULERIAN CONCEPTS OF EDDY DISPLACEMENT STRUCTURE

H. Lettau *In* Sandia Corp. Atmospheric Turbulence and Diffusion in the Planetary Boundary Layer May 1968 p 240–257 refs (See N69-35102 20-13)

Avail: CFSTI

Deficiencies of the classical model of gradient-type eddy diffusion are outlined, including negative eddy diffusivity for heat, and failure to explain root-mean-square fluctuations in cases of vanishing mean gradient. New turbulent departure equations are derived from first principles of fluid dynamics, that is the Navier-Stokes equation and the universal conservation principle for a scalar property of the fluid. Certain oversimplifications of the classical theory are contrasted with legitimate simplifications. A new turbulent transfer theory is developed based essentially on a three-dimensional vector of eddy displacements. Eulerian three-dimensional turbulence statistics are outlined, under special consideration of unidirectional mean shear flow. It is shown that major shortcomings of the classical model can be avoided. Author

N69-35121# Sandia Corp., Albuquerque, N.Mex.

ACCURACY AND REPRESENTATIVENESS OF JIMSPHERE WIND SOUNDINGS

J. W. Reed *In its* Atmospheric Turbulence and Diffusion in the Planetary Boundary Layer May 1968 p 267–269 (See N69-35102 20-13)

Avail: CFSTI

The claimed accuracy of these was ± 0.2 mils in angular measurement and ± 15 meters in range. In this experiment both radars tracked a single balloon target. One radar established the point in space of the balloon. Calculations then showed what the other radar should have been reading. This was compared to what the second radar was reading at that time. Synchronous measurements were made by the two radars every second. Representativeness was not assessed at this time. Author

N69-35122# Waterloo Univ. (Ontario). Dept. of Mechanical Engineering.

ATMOSPHERIC DIFFUSION OVER IRREGULAR TERRAIN

G. T. Csanady *In* Sandia Corp. Atmospheric Turbulence and Diffusion in the Planetary Boundary Layer May 1968 p 270–280 refs Sponsored in part by Travelers Res. Center, Hartford (See N69-35102 29-13)

Avail: CFSTI

Mathematical analysis of all facets of flow within the turbulent Ekman layer is demonstrated. In this context, atmospheric diffusion as a large-scale dispersion problem is taking place in the entire planetary boundary layer. Ground level obstacles are not distributed in a statistically uniform manner. Parameters in this analysis include an aerodynamically rough surface and the effects of changing roughness on the diffusion of large clouds in the turbulent Ekman layer. Depending on the effects of advection or local heat flux on the nonhomogeneous density distribution in the air, it is found that the simple Ekman-layer model may not apply. The use of present mathematical models is questioned for the practical prediction of cloud growth and the assessment of the shear effect on diffusion in turbulent atmospheric layers. M.H.E.

N69-35127# National Physical Lab., Teddington (England). Ship Div.

MEASURED AND VISUAL WAVE DATA AND WIND OBSERVATIONS FROM TRAWLERS

N. Hogben Apr. 1969 36 p refs

(NPL-Ship-134) Copyright. Avail: CFSTI

Visual wave and wind data collected on board ships at sea were compared with simultaneous measurements. A good correlation for wave heights was found but the one for wave period estimates was very poor particularly at short periods. ESRO

N69-35128# National Physical Lab., Teddington (England). Hovercraft Unit.

NPL HOVERCRAFT SEA STATE COMMITTEE, REPORT 2: THE DEFINITION OF SEA STATE FOR HOVERCRAFT PURPOSES

Apr. 1969 15 p refs

(NPL-Hovercraft-8) Avail: Issuing Activity

A water wave spectrum definition is set forth for coastal waters in the Solent and open sea conditions, taking into account wind force and the nature of the wave measuring instrument, to assess hovercraft performance. ESRO

N69-35166# Commissariat à l'Energie Atomique, Bruyères-le-Chatel (France).

PEACEFUL USES OF NUCLEAR EXPLOSIONS: GEOLOGY, SEISMOLOGY, BEHAVIOR OF SOILS AND ROCKS [APPLICATIONS PACIFIQUES DES EXPLOSIONS NUCLEAIRES: GEOLOGIE, SEISMOLOGIE, COMPORTEMENT DES SOLS ET DES ROCHES]

Micheline Berton Apr. 1969 190 p refs In FRENCH; ENGLISH summary

(CEA-BIB-152) Avail: CFSTI

This literature survey, a supplement to survey no. 66, consists of 754 complementary references, the documents being classified in four sections: general considerations, contained explosions, seismology and the behavior of soils, rocks and underground water during nuclear explosions or under conditions of very high pressure or temperature. Several indexes are given: subjects, authors, reports, review articles, congresses, theses. Author (ESRO)

N69-35186# Joint Publications Research Service, Washington, D.C.

AERIAL METHODS OF STUDYING AND MAPPING SANDS

N. G. Kharin et al 15 Aug. 1969 10 p refs Transl. into ENGLISH from Vestn. Sel'skokhoz. Nauki (Moscow), no. 6, 1969 p 74-80

(JPRS-48626) Avail: CFSTI

The degree of deflation of the sand masses in the zone of influence of the Kara Kum Canal has been determined by means of materials from aerial photographs taken on a special flight. The chief area of broken sands is situated along the route of the canal, which creates a threat of filling both to the canal and to other installations. In regions with widespread wind erosion the application of aerial photography permits acceleration of sand mapping, rapid compilation of a high grade chart of sand types, and determination of the degree to which they are stabilized by plant cover. This serves as a basis for planning antierosion measures. Author

N69-35173# Naval Radiological Defense Lab., San Francisco, Calif.

TURBULENT DIFFUSION IN THE INTERMEDIATE WATERS OF THE NORTH PACIFIC OCEAN

Edward A. Schuert 5 Feb. 1969 28 p refs

(Order ARPA Order 961)

(AD-688443; USNRDL-TR-69-16) Avail: CFSTI CSCL 8/3

A field experiment to measure turbulent diffusion in stable intermediate water was conducted in the Kauai channel off the island of Oahu, Hawaii, in the spring of 1968. 122,000 grams of Rhodamine BMG dye were injected with neutral buoyancy at a depth of 300 meters. The growth of the dye pool was followed for over 72 hours with towed pumping systems coupled to on-deck fluorometers. A complete description of the pool was obtained 46.5 hours after injection. Application of the data to existing theoretical models describing concentration distributions resulted in calculated characteristic parameters of energy dissipation, after Okubo, of .0066 sq cm/sec and diffusion velocity, after Joseph and Sendner, of 0.13 cm/sec. Vertical transport was extremely slow, the pool remaining approximately 2 meters thick throughout the experiment. Author (TAB)

N69-35178# Ludwig-Maximilians-Universitat, Munich (West Germany). Meteorologisches Inst.

INVESTIGATION OF THE INFRARED EMISSION SPECTRUM OF THE ATMOSPHERE AND EARTH. PART 2: BALLOON-BORNE RADIOMETERS FOR MEASUREMENTS OF THE ATMOSPHERIC INFRARED RADIATION

P. Burkert, K. Th. Kriebel, D. Rebus, and H. -J. Bolle Oct. 1968 49 p refs

(Contract AF(61-052)-778)

(AD-687741; AFCRL-69-0006-Pt-2) Avail: CFSTI CSCL 4/1

Two radiometer systems for balloon-borne application have been designed to investigate the infrared radiation field from the ground up to 30 km and the composition of the upper atmosphere. The first instrument is an eight-channel radiometer for absolute spectral measurements of the upwelling infrared radiation in different atmospheric windows and also in the 6.3 micron water vapor and 9.6 micron ozone band. The second instrument is a radiometer which allows to determine the fraction of solar radiation absorbed infrared bands of various atmospheric gases. It has to be operated from a sun stabilized platform. The report describes the instruments and test results. Author (TAB)

N69-35195# Harvard Univ., Cambridge, Mass. Lab. for Computer Graphics and Spatial Analysis.

GEOGRAPHY AND THE PROPERTIES OF SURFACES. THE USE OF THE GEODESIC CURVATURE IN THE DETERMINATION OF GEODESIC LINES

C. Ernesto S. Lindgren 28 Feb. 1969 15 p refs *Its* Paper No. 29

(Contract N00014-67-A-0298)

(AD-688457; ONR-TR-29) Avail: CFSTI CSCL 8/5

The paper introduces a method for the determination of geodesic lines based on the variation of the geodesic curvature at the points of a curved surface. Author (TAB)

N69-35332# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.

A THREE DIMENSIONAL MODEL CURRENT SYSTEM FOR POLAR MAGNETIC SUBSTORMS

Björn Bonnevier, Rolf Boström and Gordon Rostoker May 1969 48 p refs

(Rept-69-08) Avail: CFSTI

A model current system, in which magnetospheric and ionospheric sections are connected by currents flowing along the geomagnetic field lines, is proposed to represent the current system responsible for polar magnetic substorms. The magnetic perturbations from model current systems of this type are studied in terms of elementary loops, whose magnetic effects are evaluated numerically. The influence of currents induced in the ground is studied for a time-independent case, but it is found that such effects do not change the gross character of the perturbation pattern. Using a north-south chain of stations and an appropriate coordinate system the model predictions are compared with the magnetic variations observed during some substorms. It is found that the model is capable of explaining the gross features of the magnetic perturbation pattern observed. However, at times there are minor deviations from the predictions, which suggest the presence of additional ionospheric and magnetospheric current systems.

Author (ESRO)

N69-35338# Department of Energy, Mines and Resources, Ottawa (Ontario).

PUBLICATIONS OF THE DOMINION OBSERVATORY, OTTAWA. VOLUME 37, NO. 7: A SYMPOSIUM ON PROCESSES IN THE FOCAL REGION

Keichi Kasahara, ed. and Anne E. Stevens, ed. 1969 42 p refs Presented at the 14th Gen. Assembly of Intern. Union of Geodesy and Geophys. Zurich, 5 Oct. 1967

Avail: CFSTI

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3. THE STRESS STATE IN EARTHQUAKE FOCI AND THE ELASTIC STRESS FIELD OF THE EARTH L. M. Balakina, L. A. Misharina, E. I. Shirokova, and A. V. Vvedenskaya (Academy of Sci. (USSR), Moscow) p 194–198 refs (See N69-35341 20-13)

4. DISLOCATION FIELD DYNAMICS AS AN APPROACH TO THE PHYSICS OF EARTHQUAKE PROCESSES R. Teisseyre (Polish Academy of Sci., Warsaw) p 199–210 refs (See N69-35342 20-13)

5. THEORETICAL FAULT MODELS M. A. Chinnery (Brown Univ.) p 211–223 refs (See N69-35343 20-13)

6. A PHYSICAL BASIS FOR EARTHQUAKE STATISTICS L. Knopoff, C. Y. King (Calif. Univ.), and R. Burridge (Cambridge Univ.) p 224–234 refs (See N69-35344 20-13).

N69-35339# Tokyo Univ. (Japan). Earthquake Research Inst.

FOCAL PROCESSES, AND VARIOUS APPROACHES TO THEIR MECHANISM

Keichi Kasahaka *In* Dept. of Energy, Mines, and Resources Publ. of the Dominion Obs., Ottawa, vol. 37, no. 7 1969 p 187–189 (See N69-35338 20-13)

Avail: CFSTI

Three stages in a seismic cycle and various related problems are presented. The parts of the cycle are (1) the preseismic stage characterized by accumulation of potential energy, (2) the principle (rupturing) stage characterized by conversion of potential energy to kinetic energy, and (3) the postseismic stage characterized by transition to new equilibrium. Tectonic evidence and historical records support the cyclic repetition of seismic activity. J.A.M.

N69-35340# Massachusetts Inst. of Tech., Cambridge. Dept. of Geology and Geophysics.

STUDY OF EARTHQUAKE SOURCES FROM THE SEISMIC SPECTRUM

Keiiti Aki *In* Dept. of Energy, Mines, and Resources Publ. of the Dominion Obs., Ottawa, vol. 37, no. 7 1969 p 190–193 refs (See N69-35338 20-13)

(Contract AF 49(638)-1632)

Avail: CFSTI

Earthquake sources were primarily studied at two extreme frequencies, zero-frequency (static deformation) and infinite-frequency (first motions). Recent developments in long-period seismology have made it possible to use the spectral density of surface waves at long period for estimating the source parameters. Examples in which these three methods give consistent results with the assumption that an earthquake is a moving dislocation are discussed.

Author

N69-35341# Academy of Sciences (USSR), Moscow. Inst. of Earth Physics.

THE STRESS STATE IN EARTHQUAKE FOCI AND THE ELASTIC STRESS FIELD OF THE EARTH

L. M. Balakina, L. A. Misharina, E. I. Shirokova, and A. V. Vvedenskaya *In* Dept. of Energy, Mines, and Resources Publ. of the Dominion Obs., Ottawa, vol. 37, no. 7 1969 p 194–198 refs (See N69-35338 20-13)

Avail: CFSTI

The stress state in earthquake foci and the earth's elastic stress field with which earthquakes are associated are investigated by means of the analysis of the established regularities in the orientation of the principal axes of stresses active in the propagation of faults in the foci. In every investigated seismic region of the earth either the greatest relative pressure or the greatest relative tension is horizontal.

Author

N69-35342# Polish Academy of Sciences, Warsaw. Inst. of Geophysics.

DISLOCATION FIELD DYNAMICS AS AN APPROACH TO THE PHYSICS OF EARTHQUAKE PROCESSES

Roman Teisseyre *In* Dept. of Energy, Mines, and Resources Publ. of the Dominion Obs., Ottawa, vol. 37, no. 7 1969 p 199–210 refs (See N69-35338 20-13)

Avail: CFSTI

A series of discussions on earthquakes leads to the assumption that physical conditions prior to earthquake occurrences are described by some energy accumulation units. These units of energy accumulation are connected with interior inhomogeneities of the earth and from a stress point of view could be described by dislocations, cracks or other stress singularities. The discussion of energy release in earthquakes is especially convenient in terms of dislocation dynamics. The main process of internal energy release is described by annihilation of two dislocation lines of opposite sign. Energy release can thus occur when two dislocation elements join, when a dislocation reaches the earth's surface or any internal discontinuity and also in the process of thermal stress removal by a dislocation field. It is stressed that generation of dislocations corresponds rather to an internal stress concentration process. Some argumentation for the use of dislocations follows from the $1/r$ interaction type between neighbouring stress accumulation units, corresponding to a kind of superlattice. It is also emphasized that cracks or other stress singularities can be approximated by a

dislocation distribution. There follows a general approach to a unified theory by means of a dislocation density field. Thus, applications to the problem of the earth's internal processes are discussed in terms of a dislocation density field. In this paper the relation between stresses of the thermal convection and a dislocation density is especially studied. Further, dislocation flow is assumed and related to the large-scale tectonic process. In this way the stress rates in the earth's interior can be determined. Author

N69-35343# Brown Univ., Providence, R.I. Dept. of Geological Sciences.
THEORETICAL FAULT MODELS
Michael A. Chinnery *In* Dept. of Energy, Mines, and Resources Publ. of the Dominion Obs., Ottawa, vol. 37, no. 7 1969 p 211–223 refs (See N69-35338 20-13)
(Grant NSF GA-708)
Avail: CFSTI

A number of theoretical models which may be applied to the study of fault mechanics are reviewed, with particular emphasis on the boundary conditions assumed for the surfaces of the crack. The displacements and stresses which arise on the boundaries of the crack under the action of an applied shear stress are derived for each model. Particular consideration is given to the model which includes a frictional stress that increases linearly with depth. As an application of these models, the stress drops associated with some real faults are calculated in several ways using a variety of fault parameters. The calculated stress drops for vertical strike slip faults show a very small spread, and generally lie within the range of 30 to 60 bars. Similar calculations for dip slip faults have a much larger spread, probably because of inadequate field data. A discussion of the usefulness of more complex fault models is included. Author

N69-35344# California Univ., Berkeley. Inst. of Geophysics and Planetary Physics.
A PHYSICAL BASIS FOR EARTHQUAKE STATISTICS
L. Knopoff, C. Y. King, and R. Burridge (Cambridge Univ.) *In* Dept. of Energy, Mines, and Resources Publ. of the Dominion Obs., Ottawa, vol. 37, no. 7 1969 p 224–234 refs (See N69-35338 20-13)
Avail: CFSTI

A family of earthquake mechanisms is proposed to account for those earthquakes which exhibit the symptoms of sudden shear stress drop associated with shearing displacement: (1) Fracture or stick-slip frictional sliding, in which the resistance to shearing displacement, after loss of cohesion, is dry friction. This mechanism is restricted to the upper few kilometers of the earth's crust. (2) Fracture or stick-slip frictional sliding in rocks with high pressure of connate water, in which the frictional resistance to shearing displacement is decreased by the high water pressure. This mechanism is probably restricted to the sedimentary rocks. (3) Fracture or stick-slip frictional sliding is facilitated by high fluid pressure resulting from dehydration or dissociation. This mechanism can operate at any depth to which hydrous minerals can survive, perhaps 100 km. (4) Shear instability results from from the self-heating of deformation and its localization is due to the thermal activation of creep. This mechanism can operate at any depth where the appropriate magnitudes of shear stress, strain rate and activation energies occur. This is believed to be the primary mechanism of intermediate and deep-focus earthquakes. Author

N69-35436# Arizona Univ., Tucson. Inst. of Arid Lands Research.
AN INVENTORY OF GEOGRAPHICAL RESEARCH ON DESERT ENVIRONMENTS. CHAPTER 9: INVENTORY OF RESEARCH ON DESERT REGIONAL TYPES
John R. Healy 1968 69 p refs
(Contract DA-49-092-ARO-71)
(AD-686836) Copyright. Avail: CFSTI CSCL 8/6

The purpose of the inventory is to determine in detail what topics have been or are being investigated for the world's deserts, to appraise the reported work, and to disclose areas of study where further work is needed. The series of chapters does not attempt to recapitulate all information known about the deserts of the world, but rather comprises a compendium-guidebook to past and present research. It is based upon a critical review of the published literature augmented by consultations with specialists. Author (TAB)

N69-35478# Ionospharen-Institut Breisach (West Germany).
IONOSPHERE DATA, VERTICAL-ECHO-SOUNDING: FREIBURG, URSI-CODE 131, MAY 1969 [IONOSPHAEREN-DATEN, VERTIKAL-ECHO-LOTUNG: BREIBURG, URSI-CODE 131, MAI 1969] E 131, MAI 1969]
1969 44 p In GERMAN and ENGLISH
(Rept-275-F) Avail: CFSTI

Median values for the E and F regions and the results of hourly soundings are presented in tabulated form. Author

N69-35520# Lamont Geological Observatory, Palisades, N.Y.
SEISMIC SEICHES FROM THE MARCH 1964 ALASKA EARTHQUAKE
Arthur Mc Garr and Robert C. Vorhis Nov. 1968 71 p refs
(Contract AF 19(628)-4082; ARPA Order-292)
(AD-679866; Rept-25; AFCRL-68-0604) Avail: SOD $1.00; CFSTI CSCL 8/11

Seismic seiches caused by the Alaska earthquake of March 27, 1964, were recorded at more than 850 surface-water gaging stations in North America and at 4 in Australia. The seiches were recorded on bodies of water having a wide range in depth, width, and rate of flow. In a region containing many bodies of water, seiche distribution is more dependent on geologic and seismic factors than on hydrodynamic ones. The concept that seiches are caused by the horizontal acceleration of water by seismic surface waves has been extended in this paper to show that the distribution of seiches is related to the amplitude distribution of short-period seismic surface waves. Author (TAB)

N69-35525*# Volt Information Sciences, Inc., Washington, D.C.
RESULTS OF EXPERIMENTAL STUDIES OF IONOSPHERIC DRIFTS IN EASTERN SIBERIA
E. S. Kazimirovskiy et al Greenbelt, Md. NASA Goddard Space Flight Center 25 Aug. 1969 13 p refs Transl. into ENGLISH from a USSR Acad. of Sci., Siberian Div., preprint Submitted for publication
(Contract NAS5-12487)
(NASA-CR-105307; ST-AI-10859) Avail: CFSTI CSCL 04A

The results are communicated of the study of the horizontal drifts of ionization's small-scale inhomogenities in the ionosphere by the method of spaced reception with small base, conducted in Irkutsk (52°28' N.lat., 104°02' W.long.) during the period from 1957 to 1967. The results are discussed of measurements for the period of high solar activity alongside with the balance sheet of the special 1965-1966 program. It is stressed that the basic drift regularities in the IQSY period do not vary substantially by comparison with those in the IGY period. Author

N69-35554*# Techtran Corp., Glen Burnie, Md.
CERTAIN WAYS OF USING ARTIFICIAL SATELLITE OBSERVATIONS IN THE FIELD OF CONTINENTAL AND WORLDWIDE GEODESY [CERTAINES VARIANTES DE L'EXPLOITATION DES OBSERVATIONS DES SATELLITES ARTIFICIELS DANS LE DOMAINE DE LA GEODESIE CONTINENTALE ET MONDIALE]
Ludoslaw Cichowicz Washington NASA Aug. 1969 6 p refs Transl. into ENGLISH from French paper no. 68-07445 Presented at the UN Conf. on the Exploration and Peaceful uses of Outer Space, Vienna, 14–27 Aug. 1968
(Contract NASw-1695)
(NASA-TT-F-12438) Avail: CFSTI CSCL 08E

The economic and scientific reasons for using artificial satellites to establish a continental geodetic network are discussed. The technical difficulties in setting up a triangulation network for the continent of Africa, for example, are examined. The use of artificial satellites for observations of continental displacements, and for determining the motion of the terrestrial poles is treated. Author

N69-35644*# Techtran Corp., Glen Burnie, Md.
PROBLEMS OF INFRARED ATMOSPHERIC SPECTROSCOPY RELATED TO THE SATELLITE DETERMINATION OF TEMPERATURE OF UNDERLYING SURFACE [O PROBLEMAKH INFRAKRASNOY SPEKTROSKOPII ATMOSFERY, SVYAZNNYKH S RESHENIYEM ZADACHI OPREDELENIYA TEMPERATURY PODSTILAYUSCHEY POVERKHNOSTI SO SPUTNIKOV]
K. Ya. Kondratyev Washington NASA Aug. 1969 19 p refs Transl. into ENGLISH from Fiz. Atmosfery i Okeana, v. 5, no. 6, 1969 p 616–630
(Contract NASw-1695)
(NASA-TT-F-12540) Avail: CFSTI CSCL 04A

The present state of atmospheric spectroscopy is discussed from the viewpoint of information on atmospheric optical characteristics which are needed for the solution of the problem of the surface temperature determination. Reviewed are the quantitative characteristics of the radiation absorption in atmospheric windows, and the significance of aerosol attenuation is mentioned. Data on the infrared emissivity of underlying surfaces and clouds are considered. It is shown that the examined optical characteristics are not adequate because of their fragmentary nature. The realization of a wide program of further investigations is urgent. Author

N69-35648*# Illinois Univ., Urbana. Aeronomy Lab.
FULL-WAVE CALCULATION OF REFLECTION COEFFICIENTS FROM D-REGION ELECTRON-DENSITY PROFILES
W. A. Viertel and C. F. Sechrist, Jr. 1 Jan. 1969 73 p refs *Its* Aeronomy Rept. No. 33
(Grant NGR-14-005-013)
(NASA-CR-105425) Avail: CFSTI CSCL 04A

The reflection of VLF radio waves from the D-region of the ionosphere is considered. In particular, the calculation of the reflection coefficient matrix below the ionosphere is described. Full-wave theory is employed in a FORTRAN 4 computer program for use with the IBM 360 computer. The program is checked by comparing computed reflection coefficients with those obtained by an analytical method for the case of a vertical geomagnetic field and an exponential electron density model, and also with full-wave computations done by other groups for a more general case. Suggestions are given for the application of the full-wave program to the computation of VLF reflection coefficients from D-region electron density profiles measured by ground-based and rocket techniques. Author

N69-35660*# Temple Univ. Research Inst., Philadelphia, Pa.
DEVELOPMENT OF A BARIUM CHEMICAL RELEASE SYSTEM
C. S. Stokes, E. W. Smith, and W. J. Murphy Washington NASA Aug. 1969 43 p refs
(Contracts NAS1-6199; NAS1-7070)
(NASA-CR-1415) Avail: CFSTI CSCL 04A

A method for producing Ba° and Ba^{+} in a gaseous medium was developed utilizing a liquid propulsion system. The fuel consisted of $BaCl^2$ and $Ba(NO^3)_2$ salts dissolved in hydrazine. The oxidizers tested were OF_2, ClF_3 and F_2. The Ba° and Ba^{+} yield for all systems at varying oxidizer/fuel ratios was measured using spectroscopic techniques. The chemical system producing the highest yield of Ba° and Ba^{+} consisted of a 17% $BaCl_2$-16% $Ba(NO^3)_2$-67% N_2H_4 fuel mixture tested with fluorine. Author

N69-35752*# New Mexico Univ., Albuquerque. Dept. of Geography.
PHYSICAL GEOGRAPHY RECONNAISSANCE: WEST PAKISTAN
Rodman E. Snead May 1969 73 p refs Prepared for La. State Univ., Coastal Studies Inst. *Its* Publ. in Georgraphy No. 1
(Contract Nonr-1575(03); N00014-66-C-0104)
(AD-688466) Copyright. Avail: CFSTI CSCL 8/6

The study is a description of the physical and cultural features found along the West Pakistan coastal zone from the Iranian to the Indian borders. The coastal zone includes the rocky headlands, pocket bays, lagoons, and wide alluvial plains which extend, in places, 80 miles inland from the shore. The study is mainly concerned with coastal landforms, but it also discusses coastal ports and fishing villages. This is the first study to date to summarize the physiography of the entire West Pakistan coastal region. Author (TAB)

N69-35795*# California Univ., Livermore. Lawrence Radiation Lab.
ATMOSPHERIC CONSERVATION EQUATIONS IN FLUX DIVERGENCE FORM
Michael C. MacCracken 10 Feb. 22 p refs Sponsored by AEC
(UCRL-50593) Avail: CFSTI

The equations governing the behavior of the earth's atmosphere are formulated in a flux divergence form which conserves mass, energy, water vapor, and angular momentum. Special attention is paid to the fluxes due to viscous effects through study of the equations of motion for a spherical shell and a disk. It is shown that conservation of angular momentum is achieved by making the diffusive flux proportional to the negative gradient of angular velocity. Author (NSA)

N69-35802*# Joint Publications Research Service, Washington, D.C.
MEASUREMENT OF ELECTROSTATIC FIELDS IN THE EARTH'S UPPER ATMOSPHERE
I. M. Imanitov et al 14 Aug. 1969 23 p refs Transl. into ENGLISH from Usp. Fiz. Nauk. (Moscow), v. 63, no. 1, 1957 p 267–282
(JPRS-48618) Avail: CFSTI

Characteristic methods for measuring electrostatic fields in the upper atmospheric layers and means of building equipment suitable for these measurements are examined. For an oriented satellite, measurements at two points of its body, situated at the intersection of electrostatic neutrals for the corresponding components of the field intensity, reduces the determination coefficients to eight; good precision is obtained since each of the field components is determined independently. For nonoriented

satellites, the field component will be measured by a coordinate system associated with the satellite itself. Measurements when the measuring body is in the ionosphere acquire a charge from electron and ion streams on the body. Thus, it is required to establish a relationship between the potential the satellite acquires and the field intensity on its walls in order to estimate possible values of field intensities. By comparing the value of the potential obtained through evaluation of this relationship with that obtained from a curve of an ion mass spectrum, measurement results for body potential as well as for ion mass spectrum are significantly refined. G.G.

N69-35845# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.

SPECTRA OF INTERNAL WAVES AND TURBULENCE IN STRATIFIED FLUIDS. PART 1: GENERAL DISCUSSION AND INDICATIONS FROM MEASUREMENTS IN STABLY STRATIFIED ATMOSPHERE AND OCEAN

Yih-Ho Pao Jun. 1969 17 p refs Presented at the URSI/IUCRM Colloq. on Spectra of Meteorol. Variables, Stockholm, 9–19 Jun. 1969

(D1-82-0859) Avail: CFSTI

A unified spectral description of internal waves and turbulence in stably stratified atmosphere and ocean is proposed. Fluctuating motions in a free atmosphere with scales smaller than the synoptic scale consist of internal waves and turbulence were considered. At low wavenumbers, internal waves predominate. The internal waves can be identified from the characteristics of velocity-scalar co-spectra and quadrature-spectra. When the internal waves are sufficiently strong and distinct, the different harmonics of internal waves may present themselves in the auto-spectra of velocity and temperature, where the peaks and valleys are clearly identifiable. This is believed to explain the presence of peaks and valleys in some velocity auto-spectra of clear air turbulence measured in strongly stratified regions of the atmosphere. At intermediate wavenumbers (buoyant subrange), the buoyancy effect is still strong but the turbulent scrambling process becomes important; the higher-order harmonics of internal waves are no longer distinct and cannot be detected in the auto-spectra; at high wavenumbers, turbulence predominates; the characteristics of fluctuating motion in this range of wavenumbers can be described with the concept of local isotropy and are not affected by stratification. Author

N69-35870*# Techtran Corp., Glen Burnie, Md.

THE INFLUENCE OF THE EARTH'S AXIAL ROTATION ON THE RIVERS [EINFLUB DER ACHSENDREHUNG DER ERDE AUF DIE FLUESSE]

Adolf Ludin Washington NASA Aug. 1969 7 p refs Transl. into ENGLISH from Z. Ges. Wasserwirtschaft und Wasserkrafttechnik (West Ger.), v. 21, 1926 p 219–221

(Contract NASw-1695)

(NASA-TT-F-12425) Avail: CFSTI CSCL 08E

The effect of a bend in the river may be substituted for the influence of the earth's axial rotation on the rivers. The corresponding virtual bend radii measure in practice many thousands of meters. The effect of axial rotation is therefore very small and must not be overestimated. Author

N69-35911# Dominion Observatory, Ottawa (Ontario).

A PRELIMINARY ANALYSIS OF THE GRAVITY ANOMALY FIELD IN THE TIMMINS-SENNETERRE MINING AREAS WITH MAP

R. A. GIBB, J. J. G. M. van Boeckel, and R. W. Hornal 1969 46 p refs *Its* Timmins-Senneterre Mining Areas No. 58

Avail: CFSTI

The results of gravity surveys made during the period 1946 to 1963, in the Timmins–Senneterre mining area of Ontario and Quebec are presented as a Bouguer anomaly map (scale: 1:500,000). The area is studded with many granite batholiths of variable composition which are outlined by intense negative gravity anomalies. The whole region is regarded as one great roof pendant and on the assumption that the volcanic and sedimentary rocks of the area are everywhere floored by granite, it is possible to estimate the thicknesses of the volcanic belts using the gravity results; however, the depths to which the granite extends cannot be determined by the gravity method alone. A preliminary interpretation using two- and three-dimensional models to simulate major geological bodies indicates that many of the dense volcanic belts in the area extend to depths of from 3 to 5 km. Author

N69-35940# Bureau de Recherches Geologique et Minieres, Paris (France).

CONTRIBUTION TO THE SELECTION OF RADIOACTIVE TRACERS FOR HYDROGEOLOGY [CONTRIBUTION A LA SELECTION DE TRACEURS RADIOACTIFS POUR L'HYDROGEOLOGIE]

A. Lallemand Brussels EURATOM 1969 123 p refs In FRENCH; ENGLISH Summary

(Contract EURATOM-008-65-5 WASF)

(EUR-4222.f) Avail: CFSTI

A systematic study was made in the laboratory of the retention of twelve radioisotopes by different terrains, with a view to their use as tracers in hydrogeology. The tracers Cr^{51}EDTA, Fe^{59}EDTA, Ca^{45}EDTA, $Ag^{110}(CN)_{2}K$, Cs^{137}, Na^{24}, H^3, P^{32}, S^{35}, C^{14}, Br^{82} and I^{131} in solution in different types of water were tested on rocks made up of standard argilaceous minerals and on sands of varying mineralogical composition. A comparison was made in the same operational conditions of the recovery yields of these isotopes. The best results are in general obtained with the anions and with very stable chelates. Among the cations H^3 and Na^{24} are satisfactory, while Cs^{137} and P^{32} are not. Certain elements such as Ca^{45} are not of general interest, but are of interest in special circumstances. It also appears that the results obtained are often specific to the milieu and the chemical nature of the water. Author

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N69-34604# Electrotechnical Lab., Tokyo (Japan).

RESEARCHES ON PHOTOMETRIC STANDARD FOR INDUSTRY

Yasuo Mishima Jan. 1969 77 p refs In JAPANESE; ENGLISH summary *Its* Res. No. 694

Avail: CFSTI

Described are the problems in photometry for industrial purposes. Descriptions are presented of the photometric units, the primary standard of light, and incandescent lamps. Methods are given for measuring luminous intensity, flux and distribution temperature. An automatic distribution temperature meter for rapid and accurate measurement was developed. Author

N69-34628*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE CALCULATED RESPONSE OF A THREE-CRYSTAL PAIR SPECTROMETER
Clemans A. Powell, Jr. Washington Aug. 1969 35 p refs
(NASA-TM-X-1857) Avail: CFSTI

A computer analysis was made to determine the response and efficiency of a three-crystal sodium iodide scintillation spectrometer. An iterative spectrum-unfolding method was modified to analyze experimental spectra taken with the spectrometer. The response and efficiency agree well with limited experimental data. The unfolding technique yields errors in response and efficiency much smaller than those anticipated. Author

N69-34645# Arbeitsgruppe für Physikalische Weltraumforschung, Freiburg (West Germany).
POSITIONING DEVICE, HIGH VOLTAGE GENERATOR AND COUNTER ELECTRONICS FOR AN OPEN COUNTER TUBE FOR ROCKET APPLICATIONS [POSITIONIERGERAET, HOCHSPANNUNGSGENERATOR UND ZAEHLELEKTRONIC FUER EIN OFFENES ZAEHLROHR ZUM EINSATZ AUF RAKETEN]
K.-H. Hesselbacher and P. Jahnke May 1969 56 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. für Wiss. Forsch.
(BMwF-FB-W-69-17) Avail: CFSTI

A rocket experiment measuring solar Lyman alpha radiation is described, the components of which are high tension power supply, the binary counter, with storing stage and code converter, and a device for a one-directional positioning of the counter tube towards the sun. Some ideas to find the minimum design for a given digital function and an analysis of the digital to analog converter are given. Finally, a practicable way of temperature compensation of linear circuits by means of resistors with negative temperature coefficient is added. Author (ESRO)

N69-34692# Bosch (Robert) G.m.b.H., Berlin (West Germany).
MONITORING AND CONTROL OF VAPOR DEPOSITION PROCESSES BY MEANS OF QUARTZ CRYSTAL VIBRATORS [KONTROLLE UND REGELUNG VON AUFDAMPFVORGAENGEN NACH DER SCHWINGQUARZMETHODE]
Klaus Berger and Arno Illenberger *In its* Tech. Rept., Vol. 2, No. 5 Nov. 1968 p 245–252 refs In GERMAN; ENGLISH summary (See N69-34688 20-34)
Avail: CFSTI

The errors affecting the measurement of the mass deposition by evaporation on quartz crystals are investigated. The frequency shift due to heating or to the clamping stress in the crystal can be eliminated by using an appropriate clamping device. If a diaphragm is placed in front of the crystal, the resulting radial temperature gradients cause a frequency shift, which must be accounted for in the evaluation of results. A device for measuring the mass deposition and the evaporation rate and its application to the control of vapor deposition is described. ESRO

N69-34693# Bosch (Robert) G.m.b.H., Stuttgart (West Germany). Physikalisches Lab.
TEMPERATURE EFFECTS IN THICKNESS MEASUREMENTS OF EVAPORATED FILMS BY MEANS OF QUARTZ VIBRATORS [TEMPERATUREINFLUSS BEI DER DICKENMESSUNG AUFGEDAMPFTER SCHICHTEN MIT HILFE DER SCHWINGQUARZMETHODE]
Karl Kerner *In its* Tech. Rept., Vol. 2, No. 5 Nov. 1968 p 253–256 refs In GERMAN; ENGLISH summary (See N69-34688 20-34)
Avail: CFSTI

In measuring the thickness of thin films by means of a quartz vibrator, the resonant frequency is seen to depend on the temperature coefficient and moreover on the radial temperature distribution causing internal stresses. For high accuracy measurements this stress influence must be taken into account. ESRO

N69-34694# Bosch (Robert) G.m.b.H., Stuttgart (West Germany). Physikalisches Lab.
CAPACITIVE MEASUREMENT OF THIN QUARTZ PROTECTIVE COATINGS ON ALUMINUM REFLECTORS [KAPAZITIVE DICKENMESSUNG DUENNER QUARZSCHUTZSCHICHTEN AUF ALUMINIUMREFLEKTOREN]
Heinrich Knapp *In its* Tech. Rept., Vol. 2, No. 5 Nov. 1968 p 257–260 refs In GERMAN; ENGLISH summary (See N69-34688 20-34)
Avail: CFSTI

The thickness of quartz films evaporated on to aluminum reflectors determined by a capacitive measurement is compared to interferometric values and deviations are attributed to diffusion effects between the aluminum and the quartz coating. ESRO

N69-34697# Bosch (Robert) G.m.b.H., Berlin (West Germany).
ELECTRON EMISSION MICROSCOPY [AUFLICHT-ELEKTRONENMIKROSKOPIE]
Heinrich Düker *In its* Tech. Rept., Vol. 2, No. 6 Dec. 1968 p 268–278 refs In GERMAN; ENGLISH summary Presented at the Symp. on Electron Microscopy, Essen, 30 May 1968 (See N69-34695 20-34)
Avail: CFSTI

Emission and scanning electron microscopy permits the direct imaging of surfaces with a resolution of 200 Å. The principles of operation, the design of the apparatus and the methods of image generation are discussed. The scanning microscope offers greater depth of focus, but requires some time to produce a picture. The emission microscope is better suited for the observation of rapid processes and also offers better image contrast. ESRO

N69-34716*# TRW Systems Group, Redondo Beach, Calif.
RTG SCIENCE INSTRUMENT RADIATION INTERACTIONS FOR DEEP SPACE PROBES Final Technical Report, 4 Feb.–30 Jun. 1969
R. A. Kaminska, G. W. Ryan, and C.A. Smith 31 Jul. 1969 130 p refs
(Contract NAS2-5222)
(NASA-CR-73360) Avail: CFSTI CSCL 14B

The interference effects of radiation emitted by a plutonium-dioxide-fueled radioisotope thermoelectric generator (RTG) on scientific instruments carried onboard an RTG-powered spacecraft are studied. Scientific instruments commonly carried in spacecraft and the elements of the instruments most susceptible to the RTG radiation were identified. These elements, which included semiconductor detectors, plastic scintillators, CsI scintillators, and a number of other radiation detectors were exposed to a SNAP-27 fuel capsule assembly. The resultant spectral response of each detector was determined along with the effects of various separation distances, capsule orientations, and different shielding materials and thicknesses. A detailed analysis of the nuclear radiation emitted from the SNAP-27 fuel capsule was also performed, including the effect of fuel form age on the source spectrum. Author

N69-34722# Du Pont de Nemours (E.I.) and Co., Aiken, S.C. Savannah River Lab.
ACID CONCENTRATION MONITOR
Hilton R. Tilley, Sr. Mar. 1969 14 p refs
(Contract AT(07-2)-1)
(DP-1186) Avail: CFSTI

An instrument for automatically measuring nitric acid concentrations over the range 0.1 to 2.75 normal is described. Acid concentration is determined by measuring conductivity with an electrodeless conductivity cell. The instrument is reliable, capable of continuous remote operation, and accurate within ±5% of reading above 0.5 normal. Temperature compensation is accomplished electronically with a thermistor. Author (NSA)

N69-34737# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
CAMAC: A MODULAR INSTRUMENTATION SYSTEM FOR DATA HANDLING
Mar. 1969 52 p
(EUR-4100.e) Avail: CFSTI

A modular system of instrumentation is presented. This system is primarily for on-line use with digital controllers or computers and incorporates a comprehensive digital data and control highway. The specification consists of mechanical and signal standards sufficient to ensure compatibility between units developed in different laboratories. Author

N69-34738*# Harvard Coll. Observatory, Cambridge, Mass.
STUDY OF GROUND-BASED AND SPACE VEHICLE INFRARED INSTRUMENTATION FOR THERMAL PHOTOGRAPHY OF THE MOON AND PLANETS, INCLUDING EXPERIMENTAL PROGRAMS AT SELECTED OBSERVATORIES Final Report, 1 Jan. 1960 - 30 Jun. 1968
Donald H. Menzel and H. C. Ingrao Apr. 1969 15 p refs
(Grant NGR-22-007-001)
(NASA-CR-104094) Avail: CFSTI CSCL 14E

Listings of lunar data reduction from 70 nights of observation are presented. A report bibliography is included. D.L.G.

N69-34740*# Harvard Coll. Observatory, Cambridge, Mass.
RADIATION PYROMETER FOR LUNAR OBSERVATION
Hector C. Ingrao and Donald H. Menzel 1 Apr. 1969 108 p refs
(Grant NGR-22-007-001)
(NASA-CR-104096) Avail: CFSTI CSCL 14B

A radiation pyrometer developed for lunar observations is analyzed. One of the criteria for designing this pyrometer was the utilization of thermal detectors for developing techniques suitable for space instrumentation, and to make observations possible outside the United States. Moreover, the astrometric aspects of the radiometric measurements in this radiation pyrometer were seriously considered. The pyrometer has three channels: infrared, photographic (astrometric purposes), and visual. All three channels use the same telescope optics and are commutated by a two-sided mirror chopper. The pyrometer head has plug-in units, making possible the use of different thermal detectors, photomultiplier tubes, and a focusing test unit. Detailed descriptions of the electromechanical parts of the radiation pyrometer and its electronic circuitry are given. Author

N69-34849*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A LOW-ENERGY, HIGH-RESOLUTION ELECTRON IMPACT SPECTROMETER
S. Trajmar, J. K. Rice and A. Kuppermann 1 Mar. 1969 33 p refs
(Contract NAS7-100)
(NASA-CR-104084; TM-33-373) Copyright. Avail. CFSTI CSCL 14E

A low-energy, high-resolution electron impact spectrometer was designed and built. The apparatus operates in the 0 – to 100 – eV impact-energy and energy-loss range and is able to detect scattering through an angular range from −30 to +90 deg. The underlying principles of the design considerations are discussed. The operation of the instrument is described and several examples of its use as a spectrometer are given. Author

N69-34875# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
STUDY OF A SURFACE TEMPERATURE FLUXMETER FOR MEASUREMENTS IN A SHOCK-TUBE [ETUDE DU FLEXMETRE A TEMPERATURE SUPERFICIELLE POUR MESURES DANS LES TUBES A CHOC]
Jean Maulard 1969 108 p refs In FRENCH; ENGLISH summary
(ONERA-NT-139) Avail: CFSTI

The theoretical and experimental study of a thermal fluxmeter, adapted for measurements in a shock-tube, is presented. The principle of this device is recalled, and various theoretical calculations concerning this type of sensor are developed. Pieces of equipment based on this principle are described, and results obtained in a shock-tube are presented as an example. The calibration methods are discussed and a new process, based on the use of a thermal radiation, is described and compared with the classical methods based on electric heating; a difficulty attached to these methods is pointed out, experimentally and through calculation. Lastly, certain phenomena relative to the use of thin films as resistance thermometers, which have not yet been explained, are also mentioned. Author.

N69-34889# Ryan Electronic and Space Systems, San Diego, Calif.
ELECTROMAGNETIC SENSOR CORRELATION STUDY Final Report
J. M. Kennedy and F. J. Janza Jan. 1969 150 p refs
(Contract E277-68(N))
(Rept-29167-5; PB-183414) Avail: CFSTI CSCL 08H

Correlation studies between electromagnetic remote sensor outputs and hydrological signatures of the terrain such as soil moisture, snow cover and depth, and water areas show positive correspondences. Multisensor direct and cross correlations as compared to single sensor correlations, are shown to strongly increase the confidence level of the hydrological information. Author (USGRDR)

N69-34909*# Bolt, Beranek, and Newman, Inc., Van Nuys, Calif.
FABRICATION AND TESTING OF ACOUSTIC SENSORS FOR BOUNDARY LAYER FLOW TRANSITION DETECTION
Byron E. Blanchard, David E. Johnson, Klaus Kleinschmidt and Edward A. Starr Aug. 1969 115 p refs
(Contract NAS1-8472)
(NASA-CR-66801) Avail: CFSTI CSCL 14B

Seven acoustic transition detectors were fabricated and tested for use in the Pacemaker Materials Technology Experiment. These sensor systems measure location and level of turbulent pressure during and following the transition from laminar to turbulent flow in reentry. A small, rugged pressure transducer is ported to the boundary layer. This transducer is thermally protected and has

low sensitivity to vehicle vibrations while achieving broad bandwidth acoustic measurement. A signal conditioner is coupled to the transducer. The validity of the porting of the transducer to the boundary layer was tested in: (1) a supersonic wind tunnel to establish that the small porting hole did not prematurely trigger transition; (2) an arc experiment to establish that the configuration protects the transducer from the thermal environment and that the hole did not clog; (3) an anechoic chamber for response of the port under no-flow conditions; and (4) a supersonic wind tunnel for port response in supersonic flow. It was found that the port response is more highly damped in supersonic flow when compared with anechoic chamber tests. Specifically, tube resonances predominating in the no-flow tests are totally damped in Mach 3 flow. K.W.

N69-34924# Sandia Corp., Albuquerque, N.Mex.
A MAGNETIC DISK INSTRUMENTATION RECORDER
H. D. Arlowe 1969 11 p
(SC-DC-1708; PB-183108) Avail: CFSTI CSCL 14C

The paper describes a magnetic disk instrumentation recorder. This recorder is operational and is being used to record transient shock data. The paper describes both the basic capabilities of the recording system, as well as its application to several data recording situations. Author (USGRDR)

N69-34930*# Cornell Univ., Ithaca, N.Y. Center for Aerial Photographic Studies
POTENTIAL BENEFITS TO BE DERIVED FROM APPLICATIONS OF REMOTE SENSING OF AGRICULTURAL, FOREST, AND RANGE RESOURCES
Dec. 1967 150 p refs *Its* No. 3
(NASA Order R-09-038-001; NASA Order R-09-038-002)
(NASA-CR-103946) Avail: CFSTI

This report explores the uses and associated values of the information which can now or in the future be provided by remote sensing from conventional and high-flying aircraft and from satellites. Supporting material, comprising technical and economic analyses of these uses (or applications), stemmed from a detailed and critical evaluation of remote sensors and of the agricultural forest, and range resources to which they are applied. The objective of the report is to indicate the magnitude of the potential values that may be derived from remote sensing of these resources. Author

N69-34938# California Univ., Livermore. Lawrence Radiation Lab.
HAZARDS CONTROL, No. 31 Progress Report, May–Aug. 1968
Aug. 1968 72 p refs
(Contract W-7405-ENG-48)
(UCRL-50007-68-2) Avail: CFSTI

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N69-34939# California Univ., Livermore. Lawrence Radiation Lab.
HOT NITROGEN GAS FOR HEATING THERMOLUMINESCENT DOSIMETERS
K. F. Petrock and D. E. Jones *In its* Hazards Control, No. 31 Aug. 1968 p 1–8 (See N69-34938 20-14)
Avail: CFSTI

A thermoluminescent dosimeter reader using hot N_2 gas for heating the TLD phosphors is described. NSA

N69-34942# California Univ., Livermore. Lawrence Radiation Lab.
CALIBRATION OF A X-RAY SENSITIVE PLUTONIUM DETECTOR
J. F. Tinney *In its* Hazards Control, No. 31 Aug. 1968 p 24–31 (See N69-34938 20-14)
Avail: CFSTI

A calibration procedure for an X-ray sensitive plutonium detector is presented which takes into consideration the following: the isotopic composition of the plutonium contaminant, the thickness and composition of any overburden material, the influence of other radioactive materials that may be present, the size of the contaminated area, the characteristics of the radiation detector, and the source-to-detector geometry. NSA

N69-34944# California Univ., Livermore. Lawrence Radiation Lab.
A PORTABLE H 3 MONITOR USING A LARGE AREA, THIN WINDOW PROPORTIONAL COUNTER
S. Block, D. J. Hodgkins, and R. D. Taylor *In its* Hazards Control, No. 31 Aug. 1968 p 34–42 (See N69-34938 20-14)
Avail: CFSTI

A large-area, thin-window, gas-flow proportional counter was developed which will be made into a portable system whose lower limit of detection will be 1 MPC of HTO. It does not require an external pump since diffusion of gas in the atmosphere surrounding the counter provides the sample to be counted. NSA

N69-34945# California Univ., Livermore. Lawrence Radiation Lab.
TRITIUM DETECTION USING A CALCIUM FLUORIDE (EUROPIUM) SCINTILLATOR

C. T. Prevo and V. C. Santomassimo *In its* Hazards Control, No. 31 Aug. 1968 p 43–46 (See N69-34938 20-14)
Avail: CFSTI

A CaF_2(Eu) scintillator has been utilized to develop a system capable of detecting low levels of tritium in non-laboratory environments. Author (NSA)

N69-34946# California Univ., Livermore. Lawrence Radiation Lab.
INSTRUMENTATION FOR THE DETECTION OF KR 85 AND H 3 IN NATURAL GAS PRODUCING WELLS
C. T. Prevo and V. C. Santomassimo *In its* Hazards Control, No. 31 Aug. 1968 p 46–50 (See N69-34938 20-14)
Avail: CFSTI

A system which has been given the name STALLKAT (System to Analyze Low Levels of Krypton and Tritium) and consists of a gasflow ^{85}Kr proportional counter and a CaF_2(Eu) tritium scintillation detector is described. NSA

N69-34948# California Univ., Livermore. Lawrence Radiation Lab.
ADVANCE WARNING SYSTEM FOR DETECTING AR 41 BUILDUP IN ENVIRONMENTAL AIR
C. L. Lindeken and A. L. Anderson *In its* Hazards Control, No. 31 Aug. 1968 p 58–63 (See N69-34938 20-14)
Avail: CFSTI

A system based on simultaneous measurements made on the roof of the Wholebody Counting Building and within the counting room for determining advance warning of high ^{41}Ar concentrations is described. Author (NSA)

N69-34949# California Univ., Livermore. Lawrence Radiation Lab.
A SHOE MONITOR FOR LOW ENERGY BETA EMITTERS
N. A. Greenhouse *In its* Hazards Control, No. 31 Aug. 1968 p 63–64 (See N69-34938 20-14)
Avail: CFSTI

A shoe monitor using a large-area, thin-window Geiger-Mueller counter for low-energy beta detection is described. NSA

N69-34963# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
MASS SPECTROMETRY: RESIDUAL GAS ANALYSIS DURING VACUUM MELTING
W. E. Anable and E. D. Calvert Sept. 1969 11 p refs
(BM-RI-7293) Avail: Issuing Activity CSCL 14B

A 180° magnetic deflection residual gas analyzer mass spectrometer with a mass range of 2 to 200 amu was used to study the nature of gases evolved during arc and electron-beam melting of certain reactive and refractory metals. The partial pressure of residual gases over molten Mo, Hf, Ti, and Fe, was found to be similar. Water and hydrogen were evolved from the samples and from the furnace components, carbon dioxide and carbon monoxide resulted from deoxidation of some of the melts. Argon and acetone were residuals in the system, and methane was a decomposed organic compound from the oil diffusion pump. Author

N69-34998# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
CORRELATING REMOTE SENSOR SIGNALS WITH GROUND-TRUTH INFORMATION
Walter G. Eppler and Roy D. Merrill Nov. 1968 87 p
(LMSC-6-79-68-8) Avail: CFSTI

This paper describes two computer based methods for data handling and display which simplify the task of correlating remote sensor signals with ground-truth information. These techniques have been applied to microwave radiometer and infrared spectrometer flight test data. Results indicate that the digital computer, with its associated storage and display capabilities, makes possible systematic and accurate analysis of remote sensor data at low cost. In one approach, the computer is used to determine and display the exact path of the sensor boresight over the ground scene. Using this display, an investigator can observe visually certain simple correlations between the sensor return and the ground scene. In the second approach, the analyst uses a special light-pen console to put ground-truth information (in graphical form) into the computer. Using techniques for storing, retrieving, and processing graphical data, the computer automatically converts the ground-truth information into a form where it can be correlated directly with the remote sensor signals. Author

N69-35004# Polytechnic Inst. of Brooklyn. Dept. of Aerospace Engineering and Applied Mechanics.
CONSTANT CURRENT ANEMOMETER DIAGNOSTICS OF FLOW FIELDS
Bernard C. Weinberg and Samuel Lederman Apr. 1969 47 p refs
(Contract Nonr-839(38); ARPA Order-529)
(AD-688432; PIBAL-69-13) Avail: CFSTI CSCL 20/4

An experimental investigation was undertaken to determine some of the basic characteristics of the constant current hot wire anemometer. Among these were included effects of size, resistance ratio, dirt accumulation, repeatability, and applicability to certain flow fields. Tests were conducted on a turbulent pipe flow and a three-dimensional turbulent wall jet. Results characterizing these flows were also obtained. Author (TAB)

N69-35100*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PERFORMANCE CHARACTERISTICS OF LIQUID-VAPOR SENSORS OPERATING IN A REDUCED GRAVITY ENVIRONMENT
Ralph G. Adams, Bobby Bynum, Albert L. James, and Leon J. Hastings May 1969 32 p refs
(NASA-TM-X-53840) Avail: CFSTI CSCL 14B

An experimental investigation was conducted to observe the liquid retention characteristics of certain liquid-vapor sensors operating in low gravity environments. The complicated nature of these characteristics prevented analytical predictions, hence, all results were derived from Marshall Space Flight Center (MSFC) drop tower data. The results indicated that sensor liquid containment was sufficient in most cases to cause improper operation in low gravity fields. Liquid trapped on the sensing elements produced sensor measurements corresponding to uniform liquid mediums, although the sensors were actually in a vapor environment. Author

N69-35111# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
STRUCTURAL-INDUCED INTERFERENCE ON WIND SENSOR MEASUREMENTS

J. D. Horn *In* Sandia Corp. Atmospheric Turbulence and Diffusion in the Planetary Boundary Layer May 1968 p 125–142 refs (See N69-35101 20-13)
Avail: CFSTI

Airflow measurement errors are discussed in terms of interference effects created by obstacles in the flowfield. Simulation experiments are described that give quantitative results for wind defect phenomena in the wake of three types of structures. The term wind defect describes the decrease in wind speed produced by a disturbing element in the fluid flow field. Wind defect amounts near 40% were measured in the lee of a tower model and still higher values were observed in the near distance behind building and cylinder models. Author

N69-35112# White Sands Missile Range, N.Mex. Atmospheric Sciences Lab.
ATMOSPHERIC SCIENCES OFFICE TURBULENCE SYSTEM
Roy I. Glass, Jr. *In* Sandia Corp. Atmospheric Turbulence and Diffusion in the Planetary Boundary Layer May 1968 p 143–150 (See N69-35101 20-13)
Avail: CFSTI

A wind and temperature data logging system usilizing three dimensional anemometers was designed. Temperature measurements are made with high response thermocouples. The information which is sampled at five levels (2,4,8,16 & 32 meters) on a 32 meter tower is digitized in a BCD code and recorded on a magnetic tape in a computer compatible format. The data will be utilized in studies associated with dynamic similarity and diffusion measurements. Author

N69-35113# Sandia Corp., Albuquerque, N.Mex.
AN AUTOMATED METEOROLOGICAL MEASUREMENT SYSTEM
H. W. Church, R. E. Luna, J. W. Reed, and H. G. Booth (ESSA, Las Vegas, Nev. Air Resources Lab.) *In its* Atmospheric Turbulence and Diffusion in the Planetary Boundary Layer May 1968 p 153–163 Prepared jointly by Sandia Corp., Albuquerque, N.Mex. and ESSA, Las Vegas, Nev. (See N69-35101 20-13)
Avail: CFSTI

Tower instrumentation is being designed to provide meteorological information that will satisfy immediate operational needs and long-term research objectives. Operational use requires information for prediction of low level blast wave propagation and for transport and diffusion predictions in support of static nuclear rocket engine tests and underground nuclear explosion experiments. The research aims are concerned with the description of atmospheric turbulence and its effects on gaseous diffusion and on particulate deposition and resuspension. The dual purpose of the towers has lead to a combined analog-digital system, the principal element of which is a general purpose computer. The analog presentation along with digital output of certain computed quantities will satisfy operational requirements. Research requirements will be met by the use of analog records for the identification of appropriate steady state conditions and by the complete flexibility in programming the computations and digital printout of the computer. Thus, routine pre-processing of raw data through use of the reserve capacity of the data-gathering computer will permit reduction of stored data volume while retaining maximum information content. One method under consideration is the conversion of turbulent components to correlation functions and the computation of averages over various time spans. Author

N69-35115# Environmental Science Services Administration, Las Vegas, Nev. Air Resources Field Research Office.
A MOBIL RADIO TELEMETERED DATA ACQUISITION SYSTEM
Robert W. Titus *In* Sandia Corp. Atmospheric Turbulence and Diffusion in the Planetary Boundary Layer May 1968 p 167–179 (See N69-35101 20-13)
Avail: CFSTI

A remote reading wind (direction and speed) and temperature sensing system utilizing radio telemetry is described in some detail. The system includes unique features which are particularly useful in operations planned for or carried out in mountainous terrain or areas where conventional communications and power facilities are nonexistent. Author

N69-35123*# Lockheed-Georgia Co., Marietta.
SPACE RADIATION HAZARDS TO PHOTOGRAPHIC FILM IN THE APOLLO TELESCOPE MOUNT AND ORBITING WORKSHOP Final Report
C. W. Hill, D. N. Davis, and H. K. Parker, Jr. Huntsville, Ala. NASA. Marshall Space Flight Center May 1969 69 p refs
(Contract NAS8-21266)
(NASA-CR-61281; ER-10156) Avail: CFSTI CSCL 14E

A mathematical model of the Apollo Applications Program cluster geometry has been constructed. Space radiation doses to Apollo Telescope Mount (ATM) photographic film and other experiment film throughout the cluster are computed. Radiation fogging density is estimated for the ATM film, and film degradation is found to be within tolerance limits. Author

N69-35228*# Microdot, Inc., Pasadena, Calif.
THE DEVELOPMENT OF A SPACE ORIENTED PORTABLE WORK-PHOTOGRAPHIC LIGHT IN SUPPORT OF S-4B SPENT STAGE EXPERIMENTS Final Report, 1 Oct. 1968
1 Oct. 1968 8 p refs
(Contract NAS8-20679)
(NASA-CR-61550) Avail: CFSTI CSCL 14E

Development of a lamp with miniaturized circuitry and high power density is described. The lamp is to serve as a supplementary light source to astronauts for general work and photographic applications. Effectiveness criteria and major problems are briefly discussed based on experiences from constructing two prototype assemblies. K.W.

N69-35250# National Standards Lab., Chippendale (Australia).
ELASTIC COMPRESSION OF SPHERES AND CYLINDERS AT POINT AND LINE CONTACT
M. J. Puttock and E. G. Thwaite 1969 67 p refs *Its* Tech. Paper No. 25
(PB-183518) Avail: CFSTI CSCL 14B

The paper presents the formulae and data for the calculation of the compression effects which occur in the measurement and use of spheres and cyclinders in dimensional meterology. Author (USGRDR)

N69-35256*# Department of Agriculture, Washington, D.C. Natural Resource Economics Div.
AIRPHOTO USE IN RESOURCE MANAGEMENT: A SURVEY OF NON-FEDERAL PURCHASERS OF AGRICULTURAL STABILIZATION AND CONSERVATION SERVICE AIRPHOTOS

Orville E. Krause May 1969 30 p refs *Its* Agr. Inform. Bull. No. 336
(NASA Order R-09-038-001; NASA Order R-09-038-002)
(NASA-CR-103945) Avail: CFSTI CSCL 02B

Nature and extent of use of the airphotos were determined by questionnaire, a sampling plan, and statistical tests. The results are for use in studying the potential economic benefits to agriculture of remote sensing from orbiting spacecraft. The data are arranged in tables and summaries to show the following: (1) types of non-federal customers (business or government); (2) number of orders and print size, both by type of customer; (3) airphoto uses; (4) customer opinion of tone, resolution, age of imagery, and economic benefits; and (5) other sources of airphotos used by customers. K.W.

N69-35285*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
EVALUATION OF A VOLUME-RATIO SYSTEM FOR VACUUM GAGE CALIBRATION FROM 10 TO THE MINUS 8 POWER TO 10 TORR
Raymond Holanda Washington Sep. 1969 23 p refs Avail: CFSTI
(NASA-TN-D-5406) Avail: CFSTI CSCL 14B

An evaluation was made of a volume-ratio calibration system in the range from 10^{-8} to 10 torr. An error analysis showed that the pressures could be produced with a limit of error of about $\pm$1-1/2 percent at 10^{-5} torr to $\pm$4 percent at 10^{-8} torr. An analysis was made of the effects of volume-ratio and reference pressure-gage inaccuracies, temperature effects, ionization-gage pumping, ultimate pressure, transfer-volume-cycle gas generation, out-gassing, and adsorption. Sample calibrations of vacuum gages are provided. The upper and lower pressure limitations of this system are discussed. Author

N69-35314# Oklahoma State Univ., Stillwater.
INSTRUMENTATION FOR HIGH-ALTITUDE TETHERED BALLOONING
Edward C. Mangold *In* AFCRL Tethered Balloon Workshop Mar. 1968 p 123–127 (See N69-35301 20-02)
(Contract F19628-67-C-0163)
Avail: CFSTI

Details are presented on instrumentation chosen for the monitoring of the aerodynamic performance of a high-altitude tethered balloon system. Modern aerospace transducers were chosen for compatibility with an FM/FM telemetry system as well as low weight and power consumption and the ability to withstand the rigors of the high altitude environment. Particularly troublesome instrumentation problems are encountered in measuring the angle which the tether makes with the vertical at the base of the balloon in the presence of horizontal accelerations of the instrumentation package, and in the measurement of low wind velocities at high altitudes. Instrumentation requirements were considered primarily for spherical or natural shaped balloons with some consideration given to the additional measurements necessary for monitoring the performance of aerodynamically shaped balloons. Author

N69-35387*# Israel Program for Scientific Translations, Ltd., Jerusalem.
OBTAINING COLOR SCHLIEREN PHOTOGRAPHS OF RAPID PROCESSES USING THE IAB-451 INSTRUMENT
G. D. Salamandra *In its* High-Temp. Properties of Gases. Phys. Gas Dyn., Thermodyn. and Phys. of Combust. 1969 p 153–156 refs (See N69-35365 20-12)
Copyright. Avail: CFSTI CSCL 14E

The optical inhomogenities are represented in schlieren photographs by differently illuminated zones against a uniform grey background, corresponding to the undistrubed field. By means of a simple modification of Topler's scheme color photographs can be obtained on which the inhomogeneities are differently colored, each color corresponding to a definite gradient of the refraction index. Since the eye is more sensitive to a variation in color than to a variation in background illumination, color photographs give considerably more information about inhomogeneities than the usual black-and-white ones. They are particularly convenient for interpreting processes near the boundary of a solid. The color photographs enable estimates to be made rapidly of the distribution of refraction-index gradients in an inhomogeneity, and often allow a quantitative assessment to be made as well. To obtain a color Topler image, the illuminating part of Topler's scheme must be adjusted somewhat by placing a prism on the path of the beam from the light source to the first lens. This prism disperses the incident light into a spectrum. Alternatively, the knife edge can be replaced by a lattice of color filters. Author

N69-35388*# Israel Program for Scientific Translations, Ltd., Jerusalem.
APPARATUS FOR PROJECTING STILLS
N. K. Fedoseeva *In its* High-Temp. Properties of Gases. Phys. Gas Dyn., Thermodyn. and Phys. of Combust. 1969 p 157–159 refs (See N69-35365 20-12)
Copyright. Avail: CFSTI CSCL 14B

Described is a rapid projector for motion picture projection of rephotographed stills on 35 mm film. Illuminator and holder of the apparatus are mounted on an optical bench and the image of each frame is formed by a system of lenses in the focal plane of the cinecamera. G.G.

N69-35391*# Israel Program for Scientific Translations, Ltd., Jerusalem.
PULSE COUNTING CHRONOMETER FOR SHOCK-VELOCITY MEASUREMENTS
M. V. Gusev, V. A. Gordyushin, and V. D. Lobanov *In its* High-Temp. Properties of Gases. Phys. Gas Dyn., Thermodyn. and Phys. of Combust. 1969 p 175–179 refs (See N69-35365 20-12)
Copyright. Avail: CFSTI CSCL 14E

Described is an apparatus for shock velocity measurements which records the change in pressure, temperature, or illumination in a shock wave as it passes two sensors. Pulses from the sensors positioned along the path of the shock wave are recorded by oscilloscope or a chronometric device and average wave speed is calculated from the time interval between the pulses and the distance between the sensors. Author

N69-35392*# Israel Program for Scientific Translations, Ltd., Jerusalem.
AN INSTRUMENT FOR CONTROLLING THE HIGH-SPEED PHOTORECORDING OF THE PHASES OF A PROCESS
M. V. Gusev, V. D. Lobanov, and V. A. Gordyushin *In its* High-Temp. Properties of Gases. Phys. Gas Dyn., Thermodyn. and Phys. of Combust. 1969 p180–182 refs (See N69-35365 20-12)
Copyright. Avail: CFSTI CSCL 14B

Triggered photorecorders were used in conjunction with high speed schlieren photography to study expanding flows in shock tubes. An electronic circuit controlled the coincidence of the process at arrival of the shock wave in the experimental section, rotated the mirror, in position, and controlled the opening of the

high speed shutter. The shock wave position relative to the experimental section was controlled by a piezoelectric transducer whose pulse was amplified and used to trigger the flash bulb of the instrument. G.G.

N69-35401# Commissariat à l'Energie Atomique, Pierrelatte (France).
ABSOLUTE ANALYSIS OF URANIUM ISOTOPIC CONCENTRATIONS WITH A GAS ION SOURCE MASS SPECTROMETER [ANALYSES ABSOLUES DES CONCENTRATIONS ISOTOPIQUES DE L'URANIUM PAR SPECTROMETRE DE MASSE EQUIPE D'UNE SOURCE A GAZ]
Louis Chaussy and Robert Boyer May 1969 27 p In FRENCH; ENGLISH summary
(CEA-R-3752) Avail: CFSTI

Mass spectrometers with electronic bombardment ion sources are used for routine relative uranium isotopic analyses. It is shown that such mass spectrometers can also be used for very high sensitivity absolute measurements which are ten times more accurate than those obtainable with thermionic ion source mass spectrometers. Systematic errors and the experimental data are also discussed. In particular a natural uranium sample used as a reference gave: $U_5 = 0.7202 \pm 0.0005$ atom per cent $U_4 = 0.00552 \pm 0.0003$ atom per cent. This method is also useful for standards control. Author (ESRO)

N69-35418# Maine State Highway Commission. Materials and Research Div.
USE OF COLOR AERIAL PHOTOGRAPHY FOR PAVEMENT EVALUATION STUDIES IN MAINE Final Report
E. G. Stoeckeler Nov. 1968 70 p refs Prepared in cooperation with Bur. of Public Roads
(PB-183299; TR-68-6R) Avail: CFSTI CSCL 13B

Twenty-two different airphoto coverages of a short section of Interstate were taken over a one year period using three types of color film and two types of black-and-white. Scales obtained varied from 100 ft./inch to 1,000 ft./inch. A technique for comparing the relative amount of detail discernible on the different photo converages was developed. It was concluded that the maximum amount of information on pavement distress features can be extracted from Ektachrome Infrared Aero transparencies. For reconnaissance surveys of pavements, a scale of 500 ft./inch is adequate; for detailed studies, a scale of 200 ft./inch or larger is suggested. Author (USGRDR)

N69-35460# Maine State Highway Commission. Materials and Research Div.
COLOR AIRPHOTOS FOR TERRAIN ANALYSIS IN MAINE Final Report
E. G. Stoeckeler Nov. 1968 26 p refs Prepared in cooperation with Bur. of Public Roads
(PB-183300; TR-68-5R) Avail: CFSTI CSCL 13B

Three types of aerial color film flown over a variety of terrain types were evaluated. Ektachrome Infrared Aero positive transparencies were considered best for terrain studies. The resolution of the color transparencies were found to be superior to color prints made from color negative film. Author (TAB)

N69-35505*# Michigan Univ., Ann Arbor. Infrared and Optical Sensor Lab.
EFFECTS OF ATMOSPHERIC PATH ON AIRBORNE MULTISPECTRAL SENSORS
Robert Horvath, John G. Braithwaite, and Fabian C. Polcyn Jan. 1969 43 p refs
(Grants NsG-715/23-05-071; USDA-12-14-100-(20))
(NASA-CR-104206) Avail: CFSTI CSCL 14B

Experimental data were acquired for a study of the effects of variable atmospheric path on the spectral signals obtained by remote sensors in the optical region of the spectrum. Multichannel optical-mechanical scanners which provide calibrated apparent spectral radiance data were flown over agricultural test sites, and passes were made at several different altitudes between 2000 and 10,000 ft. The quantitative results compare favorably with qualitative theoretical predictions. Optical-mechanical scanners and aerial photographic systems are compared to show the relative importance of potentially detrimental atmospheric path effects with regard to the operation of these systems in remote sensing. Author

N69-35551# Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
PRINCIPLES OF ULTRASONIC INTERFEROMETERS [PRINCIPIOS DA INTERFEROMETRIA ULTRA-SONICA]
L. X. Nepomuceno [1968] 13 p refs In PORTUGUESE
Avail: CFSTI

A system of ultrasonic interferometry is studied which permits the determination of physical properties very accurately, and offers benefits to industry. The principles of single, crystal, double crystal, and short pulsed interferometers are described. The results are considered to compare favorably with laboratory results. Transl. by F.O.S.

N69-35572*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SURVEYOR LUNAR SEISMOMETER INSTRUMENT DEVELOPMENT Final Report
A. C. Dunk and E. O. Bulkley 15 Jul. 1969 59 p refs
(Contract NAS7-100)
(NASA-CR-105311; JPL-TR-32-1133) Avail: CFSTI CSCL 14B

Design, development, testing, and performance of the single-axis seismometer developed for the lunar seismology experiment on the Surveyor mission are described. The design is a compromise between the minimum detectable signal, the dynamic range and frequency response desired, simplicity and reliability, and the weight and power available. Equivalent input noise at the output of the seismometer amplifier is the sum of amplifier input noise and thermal noise generated in the resistive elements of the system input. With all other variables constant, the signal-to-noise ratio is directly proportional to the inertial mass of the seismometer sensor. The design goal of less than 1 $m\mu$ minimum detectable signal at 1 Hz was achieved using an inertial mass of 1.6 kg. The choice of a natural frequency of 1 Hz, nominal, for the mechanical suspension facilitates direct comparison with many existing short-period earthquake seismographs and permits reliable operation over the large temperature range expected, even with the sensor tilted off the vertical by more than 15°. The instrument dynamic range of 46 db is extended to 86 db through three attentuation levels (0, −20, −40 db) set by command. Author

N69-35590 Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
STUDY PROGRAM ON RELIABILITY OF LOW ENERGY DETECTORS [PROGRAMME D'ETUDE SUR LA FIABILITE SPATIALE DES DETECTEURS DE FAIBLE ENERGIE]
C. Barat and J. M. Bosqued *In* CERTS Determination of Radiation Doses in Space 1968 p 229-242 refs In FRENCH; ENGLISH summary (See N69-35577 20-29)
Copyright Avail: Issuing Activity

The main characteristics of electron multipliers without windows and their reliability are discussed. Charged particles of low energy (1 eV to 100 keV) are important because of the sun-earth relationships and precipitation in the vicinity of the earth. The detection of these low energy particles is cut off by the presence of a shielding material surrounding the sensitive part of the detector, but can be eliminated by using secondary emission phenomena for detection. With the electron multiplier without window, the threshold of detection for charged particles is brought lower down to 100 eV. As the characteristics of this detector as a function of time and irradiation are not very well known, it was necessary to carry out a reliability survey before using it in flight. The physical conditions of the space environment were successively simulated to study thirty multipliers in normal continuous operation during six months. The physical and electrical characteristics of the samples were measured in identical conditions before and after the tests of reliability. The results should bring technological improvement of future detectors and systematic studies of secondary emmission layers should reduce the detector threshold to 10 eV.
Author (ESRO)

N69-35601*# Bell Aerosystems Co., Cleveland, Ohio.
[DESIGN, DEVELOPMENT, AND THERMAL STERILIZATION TESTING OF TWO ACCELEROMETERS] Quarterly Report
15 May 1969 25 p Prepared for JPL
(Contracts NAS7-100; JPL-951492)
(NASA-CR-105314; TPR-60007-034) Avail: CFSTI CSCL 14B

Sterilization testing of two accelerometers was concluded. The final accelerometer is being built with a beryllium proofmass structure and specially heat treated springs. Two laser welded proofmass assemblies are being built containing normally manufactured springs. The fifth pendulum assembly will also utilize specially heat treated flexures in an effort to improve null stability. A transformerless pickoff electronics failed in testing due to contamination of the uA709. Otherwise, test results were satisfactory and the thermal sterilization capabilities of a bonnet of this design is promising.
Author

N69-35630*# Volt Information Sciences, Inc., Washington, D.C.
AUTOMATIC STATION ZOND-7 PHOTOGRAPHS THE MOON AND THE EARTH
1 Sep. 1969 7 p Transl. into ENGLISH from the Russian
(Contract NAS5-12487)
(NASA-CR-105288; ST-PR-LS-10865) Avail: CFSTI CSCL 14E

The press release presents black and white photographs and discusses them briefly. The pictures are of the Caspian Sea area taken from about 70,000 km; the moon from 10,000 km showing Vasco-de-Gamma, Balboa, and neighboring cirques and craters; and the limb of the moon from 2000 km showing the earth just prior to its setting behind the moon.
N.E.N.

N69-35640# Joint Publications Research Service, Washington, D.C.
A LARGE WELL-SHAPED SCINTILLATION DETECTOR
Yu. F. Koval *In its* Radiobiol., vol. 8, no. 2 1968 p 246–248
(See N69-35638 20-04)
Avail: CFSTI

A modified design of a scintillation detector for use in metabolism studies of radioactive isotopes in animals and the evaluation of their balance is described. Such instruments possess high sensitivity and allow highly accurate isotope content determination and measurement of activity in rather large organs. A scintillation plastic, placed in an aluminum, light-impermeable container with a large well, is utilized. Magnesium oxide is inserted between the walls of the container and the plastic as a reflector. The efficiency of the apparatus in recording the activity of cesium 137 was 20%, and it was concluded that it is also convenient for measuring radioactivity in small animals in vivo.
A.C.R.

N69-35660*# Beckman Instruments, Inc., Fullerton, Calif. Advanced Technology Operations.
THE DETAILED OPTICAL DESIGN OF A DOUBLE-PASS LITTROW MONOCHROMATOR FOR A MARS ATMOSPHERIC WATER DETECTION SPECTROPHOTOMETER Final Report
B. D. Henderson Aug. 1969 28 p Prepared for JPL
(Contracts NAS7-100; JPL-952552)
(NASA-CR-105303; FR-2579-101; Rept-2) Avail: CFSTI CSCL 14B

This spectrophotometer design uses a paraboloid collimating mirror and a return prism. In operation, light rays travel successively from the entrance slit of the monochromator, which is in the (X_9, Y_9, Z_9) axis system, to the collimating mirror, grating, collimating mirror, return prism, collimating mirror, grating, collimating mirror, and finally the spectral image surface, which is in the (X_{10}, Y_{10}, Z_{10}) axis system. The single collimating mirror is a paraboloid of 500 mm focal length. The diffraction grating is a replica grating of 1200 line/mm. The return prism is a 45°-90°-45° solid prism made from fused silica. The entrance slit and the PbS detector are in physical contact with a 0.25-mm-thick fused-silica plate. Final performance requirements, optimization of the optical design by means of ray-trace techniques, and a spectral image analysis are also described.
K.W.

N69-35681# California Inst. of Tech., Pasadena. Quantum Electronics Lab.
HOLOGRAPHY AND STEREOSCOPY
Nicholas George and J. T. Mc Crickerd May 1969 28 p refs Presented at the Ann. Conf. on Phot. Sci. and Eng., Los Angeles, 12–16 May 1969
(Grant AF-AFOSR-1492-68)
(AD-688895; AFCSR-69-1466TR) Avail: CFSTI CSCL 14/5

The holographic stereogram (HS) consists of an ensemble of juxtapositioned transform-holograms made from photographic transparencies of a scene. The viewer looks into the HS, as with a conventional hologram, and sees a virtual image reconstruction accurately rendering the object space. In this treatment the two basic types are reviewed: one using a single exposure with a flys-eye lens and the other a temporal sequence of photos. Their conceptual relationship to Lippmans integral photograph and Gabors hologram is explained. Analyses are presented of scaling and resolution for the sequential type of HS. Three experiments are detailed: (1) down-scaling for an HS of Beckman Auditorium, (2) brightness and blur in the overlapping region between component holograms and (3) alignment of Orbiter V photographs in making a lunar stereogram.
Author (TAB)

N69-35725# Los Alamos Scientific Lab., N.Mex.
LOW-LEVEL LINEAR GATE AND DISCRIMINATOR
C. Meynadier et al 22 Apr. 1969 8 p refs Transl. into ENGLISH from Nucl. Instr. Methods (Amsterdam), no. 65, 1968 p 183–188
(LA-4119-TR) Avail: CFSTI

A low-level linear gate and the associated discriminator are described. These units are used in a detection channeling equipment and permit to keep, after the mixture, the resolution obtained at the charge-preamplifier level.
Author (NSA)

N69-35733*# California Univ., Riverside.
PREDICTING THE DYE LAYER DENSITIES OF COLOR INFRARED TRANSPARENCIES WITH AN ADDENDUM: COLOR INFRARED PHOTOGRAPHY THROUGH SPACECRAFT WINDOWS
Robert W. Pease [1969] 31 p refs Sponsored by NASA
(NASA-CR-104208) Avail: CFSTI CSCL 14B

A method is described whereby the relative dye layer densities of Type 8443 color infrared transparency film can be predicted. A graphical method was used which involves plotting the spectral curve of energy reaching the film, weighting the energy available in discrete wave zones with an effectiveness factor for the sensitivity in the zone of each dye layer, and plotting the summations of exposure of each dye layer on a conventional D log E sensitometric diagram. It is necessary for the cyan density to be lower than those of the other two layers for a red record to show and for the magneta and yellow to have sufficient density to yield the desired red. The lowest density sets the neutral density or tone level of the color; if this is high, the overall tone will be dark. The departure of the other two densities can be considered as setting the color hue; if the neutral level is low, but the other densities are high, bright colors result. The filtering effects of spacecraft windows are also described. Author

N69-35746# Forsvarets Forskningsanstalt, Stockholm (Sweden).
SPHERICAL GYRO PLATFORM [KULGYROPLATFORM]
U. Ekstroem, K. S. Nystroem, and E. Ulen Oct. 1967 70 p refs In SWEDISH
(FOA-2-A-2502-54) Avail: CFSTI

A fully pneumatic gyrostabilized platform has been developed for use as a directional reference system. The gyro has gas bearings and pneumatic drive. The air flow for stabilizing the platform by creating the required torque is supplied by a fluid amplifier. Characteristics of construction and operation are described The platform can be stabilized in either one or two axial directions. The gyro is suited for maintaining azimuthal bearing of a target-seeking platform; in a miniaturized version it can be applied in various vehicles or missiles. For short running times the pressure medium can be a liquid, such as carbonic acid or Freon. The operating principle of this gyro is also applicable in the construction of conventional position servos. Transl. by K.W.

N69-35754*# Beckman Instruments, Inc., Fullerton, Calif. Advanced Technology Operations.
STUDY TO DETERMINE THE OPTIMAL OPTICAL DESIGN FOR A MARS ATMOSPHERIC WATER DETECTION SPECTROPHOTOMETER
B. D. Henderson 23 May 1969 72 p Prepared for JPL
(Contracts NAS7-100; JPL-952552)
(NASA-CR-105428; TR-2579-101) Avail: CFSTI CSCL 14B

The ray-trace analysis of a Mars atmospheric water detection spectrophotometer is described for use in measuring the radiant flux from Mars for four very narrow frequency bands between 7231.18 cm^{-1} and 7234.06 cm^{-1}. The bandwidth of each of these bands is controlled by individual lead sulfite detectors mounted on the spectral image surface of the monochromator with each bandwidth no greater than 1 cm^{-1}. It was found that only the double-pass Littrow monochromator with a paraboloid collimating mirror gave sufficiently good spectral image quality for this application. Its performance was equally good for either a corner return mirror or a corner return prism used at the intermediary spectral image to return the spectral image for the second pass. It was also found that the Cassegrainian monochromator produces sufficiently good spectral image quality for this application. F.O.S.

N69-35773# Texas Univ., Austin. Center for Highway Research.
INSTRUMENTATION FOR MEASUREMENTS OF LATERAL EARTH PRESSURE IN DRILLED SHAFTS Research Report
Lymon C. Reese, James Crozier Brown, and Harold H. Dalrymple Sep. 1968 126 p refs Prepared in Cooperation with Bur. of Public Roads
(PB-183148; RR-89-2) Avail: CFSTI CSCL 13B

The project involved the design, construction, and testing in the laboratory and field of instrumentation capable of measuring the lateral earth pressure along a drilled shaft. A good deal of work was done concerning the development of pressure transducers designed to measure stresses in an earth mass. Consequently, these studies produced theories which set design criteria for soil pressure measuring devices based on soil behavior. Author (USGRDR)

N69-35790*# National Bureau of Standards, Washington, D.C. Center for Radiation Research.
TABLES OF RESPONSE FUNCTIONS FOR SILICON ELECTRON DETECTORS
M. J. Berger, S. M. Seltzer, S. E. Chappell, J. C. Humphreys, and J. W. Motz Aug. 1969 59 p refs
(NASA Order-R-80)
(NASA-CR-105405; NBS-TN-489) Avail: SOD $0.60 CSCL 18D

Calculated response functions are presented which describe the pulse-height distributions produced by monoenergetic electrons incident on silicon detectors. It is assumed that the direction of incidence is perpendicular, and that the detectors are wide enough so that lateral leakage of energy is insignificant. The validity of the calculations has been confirmed experimentally for incident energies between 0.25 MeV and 1.0 MeV and detectors with thicknesses between 0.061 mm and 3.0 mm. The calculated response functions cover a wider range of conditions, including fourteen energies between 0.15 MeV and 5.0 MeV and ten detector thicknesses between 0.05 and 10.0 mm. At energies $\geq$ 1 MeV, response functions are given not only for bare detectors but also for an arrangement in which the detectors are shielded on the transmission side by another detector operating in anti-coincidence. Author

N69-35858*# Massachusetts Inst. of Tech., Cambridge. Experimental Astronomy Lab.
AERIAL PHOTOGRAPHY FOR SHALLOW WATER STUDIES ON THE WEST EDGE OF THE BAHAMA BANKS
A. Conrod, M. Kelly, and A. Boersma Nov. 1968 65 p refs Sponsored by NASA
(Contract N62306-2082; Proj. DSR-76389; Proj. DSR-71151)
(NASA-CR-104204; RE-42) Avail: CFSTI CSCL 14B

Experiments in ecological surveying and shallow water reconnaissance by aerial photography are reported. The Bimini-Cat Cay area is described in terms of its large-scale features, and the results of site surveys vs. aerial photographic interpretation are discussed. The generalized problem of depth penetration is presented, as are methods of photographic image enhancement for improved depth penetration and bottom detail discrimination. Photographic and thermal infrared imagery of Biscayne Bay is presented, though with limited discussion. Author

N69-35872*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
IMAGING OF OBJECTS VIEWED THROUGH A TURBULENT ATMOSPHERE
John C. Moldon 3 Mar. 1969 112 p refs
(Grant NGL-22-009-013; Contract DA-28-043-AMC-02536(E); Proj. 200-14501-B31F)
(NASA-CR-105397; TR-469) Avail: CFSTI CSCL 17H

This report is concerned with estimating the high resolution amplitude and phase parameters of the spatial Fourier transform of an object illuminated with incoherent radiation and viewed through a turbulent atmosphere. The Cramer–Rao technique is employed to lower-bound the variance of any unbiased estimator, and receiver structures that approach these bounds are then exhibited. It is found that significant improvement over many existing systems is often possible, provided one is willing to pay for increased system complexity. The reduction of the processors to somewhat less efficient but more practically attractive forms is then considered. Some experimental results are presented which illustrate the effects of turbulence on wave-front coherence. Author

N69-35891# National Bureau of Standards, Washington, D.C. Mechanics Div.

GRAVITY MEASUREMENTS AND THE STANDARDS LABORATORY

D. R. Tate Aug. 1969 11 p refs
(NBS-TN-491) Avail: SOD $0.25

The local value of the acceleration due to gravity is a fundamental datum for almost every standards laboratory as it, together with accurate standards of mass, is the basis for the standards involving force. Instruments used as standards in this area include precise deadweight piston gages, deadweight calibrators for force transducers, liquid manometers, and earth field accelerometer calibrators. The practical realization of the absolute ampere and the absolute volt require a knowledge of force. This paper presents the basic information about how gravity measurements are made and outlines procedures for obtaining a suitable value for a given location. It also gives a brief discussion of the background and meaning of the term standard gravity, and its application in the computation of forces in units of the pound-force and the kilogram-force. Author

N69-35947*# General Oceanology, Inc., Cambridge, Mass.

GRAVITY GRADIENT PRELIMINARY INVESTIGATIONS ON EXHIBIT "A" Final Report

Lloyd G. D. Thompson, Mark H. Houston, and Daniel A. Rankin 31 Jul. 1969 88 p refs
(Contract NAS9-9200)
(NASA-CR-101867; GO-Rept-9) Avail: CFSTI CSCL 14B

Preliminary laboratory experimentation with a modified off-the-shelf quartz microbalance and proof masses gave vertical gravity gradient measurements accurate to 90 Eötvös units and an instrument resolution or sensitivity of 10 Eötvös units. Most of the measurement error was found to be caused by known local disturbing environmental effects which could be readily eliminated. Improved instrumentation with 1 Eötvös unit resolution and 5 to 10 E.U. accuracy for field surveys is considered achievable. Under quiet environmental conditions in a special laboratory facility or space vehicle, 0.1 Eötvös unit resolution and 1 Eötvös unit accuracy can be expected. This successful use of existing instrumentation for direct gradient measurements is cause for renewed interest in an orbital spacecraft experiment and lunar surface exploration. A portable exploration model gradiometer has immediate application for surface exploration of the earth and moon. Author

N69-35956# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STUDY OF THE IDENTIFICATION OF SMALL TOPOGRAPHIC OBJECTS ON LARGE-SCALE AERIAL PHOTOGRAPHS [IZUCHENIE DESHIFRIRUYEMOSTI MALYKH TOPOGRAFICHESKIKH OBEKTOV NA KRUPNOMASSHTABNYKH AEROSNIMKAKH]

L. M. Goldman Nov. 1967 19 p refs Transl. into ENGLISH from Tr. Tsentr. Nauchn. Issled. Inst. Geod. Aerosyemki i Kartografii (Moscow), no. 149, 1964 p 127–139
(AD-678797; FTD-MT-67-24) Avail: CFSTI CSCL 14/5

The identification of small features on various large-scale aerial photographs is investigated. Wooded regions of the upper Volga and the cleared settled areas of the Southern Ukraine were photographed at the scales of 1:2000, 1:6000 and 1:12,000. In order to determine the optimal combination of photograph scale and type of film, the following were used: black and white panchromatic type 10, color multilayer TSN-1, and color spectrozonal SN-2. The following experimental films were also used: color spectrozonal SN-5 in both regions, color spectrozonal SN-23 (3-color) in the wooded region, and color multilayer DS-5 in the cleared region. Author (TAB)

N69-35981# Ballistic Research Labs., Aberdeen Proving Ground, Md.

DETECTION OF RADIANT ENERGY BY THE PYROLECTRIC EFFECT

Konrad Frank and Ona R. Lyman Apr. 1969 72 p refs
(AD-688868; BRL-1432) Avail: CFSTI CSCL 17/5

The theory of the pyroelectric effect is presented, and it is shown that the pyroelectric detector element can be treated as a capacitor with a power-proportional current source. An electrical equivalent circuit is developed which, in combination with a thermal equivalent circuit, completely describes the response of a detector to any power input. The modes of operation of the detector are discussed and the geometric and material properties affecting the conversion efficiency are delineated. The techniques used in fabrication and testing the detectors are described. For several poled ceramics the current responsivities were determined with a carbon dioxide laser. In addition, the detectors were used with other lasers, and operational results with power levels from 5 mW to 30 MW are presented. Author (TAB)

N69-35984# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Institut fuer Dynamik der Flugsysteme.

PIEZOELECTRIC VARIOMETER FOR THE MEASUREMENT OF TIME PRESSURE GRADIENTS IN GASEOUS OR LIQUID MEDIA [PIEZOELEKTRISCHES VARIOMETER ZUR MESSUNG ZEITLICHER DRUCKGRADIENTEN GASFOERMIGER UND FLUESSIGER MEDIEN]

Bernd Korndoerfer *In its* DVL News, No. 39 Mar. 1969 p 458–460 In GERMAN (See N69-35976 20-34)
Avail: CFSTI

A short description is given of a new temperature-compensated piezoelectric pressure gage operating with very low inertia. ESRO

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N69-34806# Gulf General Atomic, San Diego, Calif.
ENGINEERING METHOD FOR THE EVALUATION OF STEAM GENERATOR VIBRATIONS
William J. Kellar 14 Feb. 1969 10 p ref Presented at USAEC/RDT Meeting on Heat Exchanger Vibrations, 19–20 Feb. 1969
(Contract AT(04-3)-633)
(GA-8292) Avail: CFSTI

An engineering method for evaluating vibration effects on heat exchanger tubing linearizes the vibration equation by substituting a magnification factor for the damping term and recognizing that the aerodynamic driving force is Reynolds number-dependent. Feedback between tube and fluid stream is neglected for small amplitudes. Magnification factors are used that are determined from component vibration tests and lift coefficients from flow tests. Scaled models of tube arrays were also used to determine lift coefficients. A test program was completed for the development of a device to reduce tube damage from long term low level vibrations using a tube support method. This method provides tube support and wear protection. Long duration testing (10^8 cycles) showed no tube surface damage to either ferritic or nickel alloy tubes.
NSA

N69-34707*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INFLUENCE OF VARIOUS FABRICATION METHODS ON THE COMPRESSIVE STRENGTH OF TITANIUM SKIN-STRINGER PANELS
Richard A. Pride, Dick M. Royster, and James E. Gardner Washington Aug. 1969 44 p refs
(NASA-TN-D-5389) Avail: CFSTI CSCL 20K

Thirty-seven skin stringer panels were fabricated from Ti-8Al-1Mo-1V titanium alloy by riveting, resistance and arc spotwelding, tungsten inert gas and electron beam fusion welding, and diffusion bonding in order to investigate the effect of the various fabrication methods on the compressive strength. Also included in the investigation were two integrally stiffened panels machined from thick plate. The panels were representative of airplane wing or fuselage surfaces. Experimental buckling and maximum loads were determined for each panel. Results of strength tests for the various joining techniques were compared with each other and with compressive strength calculations. The quality of the joining methods was generally good as evidenced by the behavior of the skin stringer panels in end compression. The joining methods maintained the integrity of the joint through buckling up to the maximum compressive strength of the panels. The maximum strengths of the panels showed good conformity with calculated results obtained from existing compressive strength analyses.
Author

N69-34807# Grumman Aircraft Engineering Corp., Bethpage, N.Y.
TRACKED AIR CUSHION RESEARCH VEHICLE. VOLUME 1: RESEARCH VEHICLE PRELIMINARY DESIGN Final Report
Mar. 1969 203 p refs (Contract DOT-FR-9-0003)
(PB-183172; FSR-ST-4) Avail: CFSTI CSCL 13F
The report contains a preliminary design and development plan for a research tool to validate tracked air cushion vehicle technology.
USGRDR

N69-34808# Grumman Aircraft Engineering Corp., Bethpage, N.Y.
TRACKED AIR CUSHION RESEARCH VEHICLE. VOLUME 2: RESEARCH VEHICLE DEVELOPMENT PLAN. PART 1: TECHNICAL PLANS Final Report
Mar. 1969 31 p refs
(Contract DOT-FR-9-0003)
(PB-183173; FSR-ST-5A) Avail: CFSTI CSCL 13F

This plan describes the progression of work and facility requirements for the design, construction and qualification testing of the TACRV. This is a portion of the overall plan for development of a future tracked air cushion vehicle system which is a key link in the determination of dynamic performance characteristics necessary to further system development.
Author (USGRDR)

N69-34809# Grumman Aircraft Engineering Corp., Bethpage, N.Y.
TRACKED AIR CUSHION RESEARCH VEHICLE. VOLUME 3: RESEARCH VEHICLE RESEARCH PLAN Final Report
Mar. 1969 106 p refs
(Contract DOT-FR-9-0003)
(PB-183174; FSR-ST-6) Avail: CFSTI CSCL 13F

The TACRV program will provide test data on ride comfort, performance, efficiency and level of noise in operation, for use in the final design of a public demonstration system. The TACRV will be used to obtain test operation data, under actual forward speed conditions, in the areas of air cushion performance, suspension system dynamics, vehicle stability and control dynamics, vehicle/guideway dynamic interactions, linear induction motor (LIM)/vehicle performance and internal cabin and far field acoustics.
Author (USGRDR)

N69-34814# Aeroglide Systems, Inc., New York.
A PRELIMINARY DESIGN STUDY FOR A TRACKED AIR CUSHION RESEARCH VEHICLE. VOLUME 1: GENERAL REPORT Final Report
Francois L. Giraud Feb. 1969 262 p refs
(Contract DT-7-35337)
(PB-183319) Avail: CFSTI CSCL 13F

The first part of this study attempts a comparison of different configurations of high speed air cushion vehicles and guideways. Different means of propulsion are compared. The second part of this study aims at describing a vehicle and trace to perform a test program. A common vehicle frame equipped with a fan jet can accommodate the existing linear induction motor. Tests of the most interesting track form and structure, tests of all suspensions and trials of alternate means of aerodynamic propulsion with their noise attenuation systems can be performed.
Author (USGRDR)

N69-34815# Aeroglide Systems, Inc., New York.
A PRELIMINARY DESIGN STUDY OF A TRACKED AIR CUSHION RESEARCH VEHICLE. VOLUME 2: GUIDEWAY STUDY REPORT
New York Parsons, Brinckerhoff, Quade and Douglas, Inc. Dec. 1968 112 p refs Prepared in cooperation with Parsons, Brinckerhoff, Quade and Douglas, Inc.
(Contract DT-7-35337)
(PB-183320) Avail: CFSTI CSCL 13F

This report describes the development of preliminary design tradeoff studies for a single vehicle aerial guideway to accommodate a vehicle traveling on air cushions at speeds up to 300 miles per hour. Three guideway structure types were studied: (1) the Inverted Tee; (2) the Double I (or Channel); and (3) the Box (or Inverted Channel). Each of these structural types were analyzed for the purpose of determining the most economical construction material, the optimum span length, the tolerance requirements, construction methods and maintenance procedures.
Author (USGRDR)

N69-34846# General Electric Co., Philadelphia, Pa. Transportation Systems Div.
TRACKED AIR CUSHION RESEARCH VEHICLE: PRELIMINARY DESIGN STUDY REPORT
17 Mar. 1969 222 p refs
(Contract DOT-FR-9-0004)
(PB-183179; Rept-69AT-1002) Avail: CFSTI CSCL 06F

This report presents a preliminary design for a Tracked Air Cushion Research Vehicle (TACRV). The proposed design meets performance, design, and test requirements prescribed by the OHSGT. The research program test requirements emphasize air cushion and suspension research. Additional research program investigations include subsystem interactions, aerodynamics, propulsion, noise, and vehicle/guideway interactions, especially as they affect ride quality and operational guideway design requirements. The experimental program is to provide engineering data and verification of analyses that will be applicable to the design of public demonstration TACV systems. Author (USGRDR)

N69-34847# General Electric Co., Philadelphia, Pa. Transportation Systems Div.
TRACKED AIR CUSHION RESEARCH VEHICLE: DEVELOPMENT PLAN STUDY REPORT
17 Mar. 1969 72 p refs
(Contract DOT-FR-9-0004)
(REPT-69AT-1003; PB-183177) Avail: CFSTI CSCL 13F

The objectives of this R/V Development Plan are to indicate the schedules for, and to describe the efforts necessary to accomplish the refinement of the vehicle design details, development of subsystems, fabrication and assembly of the research vehicle, and the performance of suitable component and vehicle qualification and performance tests. Its further objective is to include schedule estimates for the production of all ground support equipment, checkout systems, and spares necessary to implement the proposed research use of the vehicle. Author (USGRDR)

N69-34848# General Electric Co., Philadelphia, Pa. Transportation Systems Div.
TRACKED AIR CUSHION RESEARCH VEHICLE. PRELIMINARY DESIGN STUDY REPORT: APPENDICES
17 Mar. 1969 473 p refs
(Contract DOT-FR-9-0004)
(REPT-69-AT-1007) Avail: CFSTI CSCL 13F

The overall objective of the research vehicle test program will be to advance the state-of-the-art of vehicle and guideway technology sufficiently to design, with a high level of confidence, full-scale operational vehicles having high performance, excellent ride qualities, and community acceptability. Author (USGRDR)

N69-34928# Atomic Weapons Research Establishment, Aldermaston (England).
CHARGING CHOKE DESIGN FOR THE HICUP MODULATOR
G. M. Ward Feb. 1969 37 p
(AWRE-O-7/69) Avail: CFSTI; HMSO: 5s 6d

A machine known as HICUP (Hydraulic Impulse Crushing Unit Project) was designed for efficiently charging and discharging load capacitors. The machine was employed for electrohydraulic crushing of brittle materials and was capable of 4kW of spark power. The design of the charging choke incorporated into the machine is described. The interactions of such parameters as rms current, peak ampere turns, pulse repetition frequency and size are considered. The development of a graphical method for general application is presented. Author (NSA)

N69-34988*# Solar, San Diego, Calif.
DEVELOPMENT OF END FITTINGS FOR BERYLLIUM STRUCTURAL TUBING Final Report
T. L. Stockham Jul. 1967 78 p
(Contract NAS8-20151)
(NASA-CR-86787; ER-1688-14) Avail: CFSTI CSCL 13E

This is the final report of a program to develop efficient methods of fabricating strut assemblies consisting of beryllium tubing and end fittings. The work consisted of the design and analysis of the strut assembly and components, laboratory evaluation of joining methods, procurement of beryllium forgings and tubing, testing of full-scale attachments on short tubes, and assembly of two 40.60-inch long struts. The joint configuration consists of a stainless steel lap strap, adhesive bonded to the butted beryllium tube and end fitting. Processing variations produced premature adhesive failure on two parts, but the problems have been identified and corrected, and tests on other assemblies demonstrated the capability of the joint to exceed design requirements. The end fittings, machined from beryllium forgings and the extruded beryllium tubing exceeded design requirements. No failure of these beryllium components was experienced during the test program. The high quality evident in these procured materials represents the best current state of the art in beryllium production. Author

N69-34983# Sandia Corp., Albuquerque, N.Mex.
INTERAGENCY MECHANICAL OPERATIONS GROUP (IMOG), NUMERICAL SYSTEMS GROUP INTERIM MEETING Minutes
Harvey Frauenglass Mar. 1969 31 p Conf. held at Livermore, Calif., 4–5 Mar. 1969 Sponsored by AEC
(PB-183559; SC-DR-69-175) Avail: CFSTI CSCL 13H

Summary of activities; Discussion and action; Postprocessor specification; and Roster of IMOG/NSG members. USGRDR

N69-35124*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MEASURING THE CONDUCTOR SPACING IN FLAT CONDUCTOR CABLES
Wilhelm Angele 13 Jun. 1969 25 p refs
(NASA-TM-X-53843) Avail: CFSTI CSCL 13H

The need for accurate conductor spacing in flat conductor cables (FCC) calls for appropriate inspection methods and equipment. A simple visual display of the positions of the conductors within the cable can be accomplished by superimposing the test cable over a standard cable. This forms an optical interference pattern called moire. The quantitative analysis of several moire patterns is explained in some detail. The moire is a fast and accurate tool for inspecting the conductor spacings in translucent FCC. Author

N69-35168# Lockheed Missiles and Space Co., Sunnyvale, Calif.
STARTING PERIOD OF MICROCRYOGENIC APPARATUS
A. D. Suslov [1968] 5 p Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinostro. (Moscow), no. 5, 1969 p 97–101
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Analyzed are the starting modes of microcryogenic units by considering the fundamental characteristics of the coolants in computing the duration of the starting periods. A throttle unit will yield the shortest starting period in thermostatic small units since its quantity corresponds to the theoretical cold productivity and forced modes can be eliminated by a diminution in shutdown cooling mass. If the reduced mass of the unit is measured in tens of grams, then the gas refrigerator forges ahead. G.G.

N69-35187*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
WSTF FILTER TEST PROGRAM Interim REport
I. D. Smith 28 Jan. 1969 89 p
(NASA-TM-X-61787; TR-WSTF-007) Avail: CFSTI CSCL 13L

Two interface propellant filters were subjected to special contamination holding capacity tests. The tests were designed to determine the maximum sized particle passed by the filters and the relationship between the pressure drop across a filter and the amount of contaminant added upstream of the filter. Deionized water was used as the fluid test medium and a mixture of coarse dust and iron pyrites as the contaminant. The particle count per 500 ml sample during the contamination addition portion of the test indicated that both filters met the criteria of size range (between 0 and greater than 100 microns) and maximum number (between unlimited and 0). The flow rate versus Delta P characteristics of the filters was also determined using clean deionized water. K.W.

N69-35188# Forsvarets Forskningsanstalt, Stockholm (Sweden).
NUMERICAL CALCULATION OF THE COURSE OF A METAL PLATE IN EXPLOSIVE CONTACT WITH A FORM PLATE [NUMERISK BERAEKNING AV FOERLOPAET VID PLANT METALLUTKAST FRAN EN SPRAENGAEMNESPLATTA]
Ake Persson Nov. 1967 42 p refs In SWEDISH
(FOA-2-C-2203-23) Avail: CFSTI

Hydrodynamic partial differential equations and a numerical integration method for the space-time development are used to analyze the explosive interaction of a shock wave, a form plate, and a brass plate. The shock wave fronts are dealt with by the Von Neumann-Richtmeyer q-method, the detonation front by the Wilkins f-method. The calculations were programmed in FORTRAN 2 and performed on an IBM 7090 computer. Three examples were calculated, each having a different ratio of explosive load to mass. Experimental verification of the numerical method shows good agreement and accuracy. Transl. by K.W.

N69-35192# Wisconsin Univ., Madison. Dept. of Statistics.
CHARACTERIZATION OF GRINDING WHEEL PROFILES BY AUTOREGRESSIVE-MOVING AVERAGE MODELS
C. M. Stralkowski (Du Pont Co., Wilmington, Del.), S. M. Wu, and R. E. De Vor Nov. 1968 46 p refs
(Grant NSF GK-1695)
(PB 183579; TR-184) Avail: CFSTI CSCL 13I

The cutting profiles of three common grinding wheels were analyzed by Box-Jenkins autoregressive-moving average models. The analysis involves three stages, i.e., identification, estimation, and diagnostic checking. It was found that second-order autoregressive models represent the profiles of the three wheels fairly well. An analysis of replicate profiles taken from each wheel indicated that the profiles were ergodic. The models and their parameters were related to the qualitative characteristics of the profiles. The analysis was achieved through the use of many charts developed for engineering applications. Author (USGRDR)

N69-35298# Politecnico di Torino (Italy). Istituto di Macchine e Motori per Aeromobili.
RESEARCH ON THE ACCELERATION OF INTERNAL COMBUSTION ENGINES FOR AUTOMOBILES [RICERCHE SULLA RIPRESA ED ACCELERAZIONE DEI MOTORI A COMBUSTIONE INTERNA PER AUTOVETTURA]
Federico Filippi and Enrico Antonelli Sep. 1967 25 p refs In ITALIAN
(Contract CNR-115-0375-200).
(Publ-89) Avail: CFSTI

Engine tests for cars during acceleration are discussed. The test equipment is described and includes a dynamometer, electronic instrument for the digitization of the spark advance angle and for the determination of knock intensity together with a set of monitoring instruments. Analyses of some fuels are also discussed. ESRO

N69-35316# Air Force Cambridge Research Labs., Bedford, Mass.
GENERAL PURPOSE BALLOON TETHERING WINCH
Lewis A. Grass *In its* Tethered Balloon Workshop Mar. 1968 p 137-143 (See N69-35301 20-02)
Avail: CFSTI

This paper describes a traction drive winch system capable of handling 1/8-through 3/8-in. cable with loads up to 12,000 lb. A 110-hp industrial engine powers a unique hydraulic system. This system can operate with stepless control between 0 and 1000 ft/min and provides controlled tension to the storage drum. Traction drive, level weind, and fairclad assembly were coated with PVC to minimize abrasion of the cable. Author

N69-35426# Illinois Univ., Urbana. Engineering Experiment Station.
RESTRAINT CHARACTERISTICS OF FLEXIBLE RIVETED AND BOLTED BEAM-TO-COLUMN CONNECTIONS
C. W. Levitt, E. Chesson, Jr., and W. H. Munse 1969 112 p refs Prepared in cooperation with Bur. of Public Roads, Washington, D.C.
(PB-183585; ILU-EES-Bull-500) Avail: CFSTI CSCL 13E

The behavior of flexible riveted and bolted beam-to-column connections is described along with the factors which influence their moment-rotation characteristics. The load-deformation expressions for angle segments can be determined analytically for deformations that are sufficiently large to insure plastic hinges at three critical locations in the angles. Recommendations are made for the utilization of the restraint characteristics of flexible connections in design. The savings in beam weight are shown as is the reduction in depth, depending on loading conditions and framing. Author (USGRDR)

N69-35448# General Electric Co., Philadelphia, Pa.
TRACKED AIR CUSHION RESEARCH VEHICLE RESEARCH PROGRAM STUDY REPORT
17 Mar. 1969 83 p
(Contract DOT-FR-9-0004)
(PB-183178; Doc-69AT-1004) Avail: CFSTI CSCL 13F

Tests of a full-size engineering research and development tracked air cushion vehicle (TACV) and guideway system are reported. Information to advance the state of the art in high speed ground transportation in respect to ride comfort, performance, efficiency and level of noise in operation, and the engineering data, analytical tools and design guidelines needed for the design of an attractive, high performance public demonstration TACV and guideway system are presented. Author (USGRDR)

N69-35503# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Munich (West Germany). Institut für Flugtreib- und Schmierstoffe.
ON LUBRICATION PROPERTIES OF MOLYBDENUM DISULFIDE POLYTETRAFLUOROETHYLENE DOUBLE LAYERS IN HIGH VACUUM [UEBER DAS SCHMIERVERHALTEN VON DOPPELSCHICHTEN AUS MOLYBDAENDISULFID UND POLYTETRAFLUORAETHYLEN IM HOCHVAKUUM]
G. Spengler and W. Hellwig Apr. 1969 28 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-21; DVL-858) Avail: CFSTI

A method of coating shaft bearing surfaces with a double layer of MoS_2 and polytetrafluoroethylene is described and the influence of a pretreatment, the layer thickness on the coefficient of friction and the life of bearings are discussed. ESRO

N69-35789*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TORQUE AND LEAKAGE RATES OF VARIOUS LUBRICATED LIP SEAL DESIGNS AT A PERIPHERAL VELOCITY OF 120 FEET PER SECOND
Lawrence P. Ludwig, Thomas N. Strom, and Robert L. Johnson Washington Sep. 1969 16 p refs
(NASA-TN-D-5411) Avail: CFSTI CSCL 11A

Lip-type shaft seals were run at peripheral velocities representative of requirements in mechanical components for rocket engines. The seals with butyl rubber lips had prominent wear-in torque peaks that were attributed to lip temperature rise and subsequent lip shrinkage (Gow-Joule effect). This effect could cause sudden failure; gradual wear-in, however, reduced failure probability. The seals with glass-filled polytetrafluoroethylene lips also exhibited wear-in torque peaks. The seals with graphite-filled polytetrafluoroethylene lips exhibited low leakage and good wear characteristics. Running torques of the various lip seal types were similar to that of a segmented-carbon shaft seal. For butyl and graphite-filled polytetrafluoroethylene lip seals, the dynamic gas leakage rates were similar to the static leakage rates. Author

N69-35788*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LUBRICANTS FOR INERTED LUBRICATION SYSTEMS IN ENGINES FOR ADVANCED AIRCRAFT
William R. Loomis, Dennis P. Townsend, and Robert L. Johnson Washington Sep. 1969 22 p refs
(NASA-TN-D-5420) Avail: CFSTI CSCL 11H

The feasibility of using presently available liquid lubricants in advanced high-speed aircraft engines was studied with both nitrogen inerted recirculating and once-through mist lubrication systems. Three fluids (a mixed ester, a synthetic paraffinic hydrocarbon, and a perfluorinated polymeric fluid) performed satisfactorily with the recirculating system in 3- to 10-hour runs in a full-scale simulated aircraft bearing and seal assembly at outer race bearing temperatures to 700° F (644K) and with a bulk fluid temperature of 500° F (533K). The principal problem was excessive leakage of the oil-side bellows face seal. Only one lubricant (synthetic paraffinic hydrocarbon) performed satisfactorily with the once-through mist system at a bearing temperature of 600° F (589K). Author

N69-35799*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INVESTIGATION OF ISOTHERMAL, COMPRESSIBLE FLOW ACROSS A ROTATING SEALING DAM. 1: ANALYSIS
John Zuk and Lawrence P. Ludwig Washington Sep. 1969 38 p refs
(NASA-TN-D-5344) Avail: CFSTI CSCL 11A

The flow across a parallel sealing dam of the type that appears in gas turbine seals is analyzed for steady, laminar, subsonic, isothermal compressible flow with relative rotation of the sealing dam surfaces. Rational effects in velocity profiles pressure profiles, and other physical quantities of interest are found. Conditions are given under which a hydrostatic analysis of the radial pressure flow is a valid approximation. The error in estimating the mass leakage by using the hydrostatic radial flow formula is given. Author

N69-35859*# National Aeronautics and Space Administration, Washington, D.C.
MECHANISMS WITH ELASTIC COUPLINGS: DYNAMICS AND STABILITY
A. Ye. Kobrinskiy Washington NASA Jun. 1969 315 p refs Transl. into ENGLISH of the book "Mekhanizmy s Uprugimi Svyazyami. Dinamika i Ustoychivost" Moscow, Nauka Press, 1964
(Contract NASw-1695)
(NASA-TT-F-534) Avail: CFSTI CSCL 13E

Elastic couplings, as contrasted to elastic links are not actually a part of a mechanism's kinematic linkage. These couplings are analyzed under conditions of vibrating support or pulsating external forces. Vibrating and vibroimpact mechanisms are analyzed. A brief outline of the elements of the theory of differential and difference equations is included. The effects of friction and of clearances on kinematic pairs are analyzed. Author

N69-35886# Oak Ridge National Lab., Tenn.
DISTRIBUTION OF UNIFORM PRESSURE ON THE CONTACT ARC OF METAL WITH THE ROLLS
J. Bazan [1969] 21 p refs Transl. into ENGLISH from Arch. Hutnictwa (Warsaw), v. 13, no. 1, 1968 p 55–76
(ORNL-tr-2113) Avail: CFSTI

A solution of the Karman differential equation on the basis of up to date investigations concerning the openings between the bodies of rolls is given. Prior to a particular solution of the general equation, an additional equation was assumed resulting from the shape of the tool, mechanical properties of the metal and the existing friction on the contact surface of the metal with the rolls. The contact arc was replaced by a chord of equations, and the parabolic strength strain hardening of the metal was assumed. The possibility of appearing in the retardation zone as in the forward creeping zone, of three subzones of friction including the slipping, contacting, and dead zone was assumed. Variations of the friction force values in the individual subzones are given. The substitution of additional equations enables a general solution, and after the substitution of boundary conditions—a particular solution. Five formulas were obtained for calculating the unitary pressure: for the slip, the contacting and the dead zone. Author (NSA)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N69-34603*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
HOLOGRAPHIC RECONSTRUCTION OF SPATIAL DISTRIBUTION OF A LASER LIGHT FIELD [GOLOGRAFICHESKOYE VOSSTANOVLENIYE PROSTRANSTVENNOGO RASPREDELENIYA SVETOVOGO POLYA OKG]
M. S. Soskin et al Washington NASA Aug. 1969 5 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 14, no. 2, p 303–307
(Contract NASw-1692)
(NASA-TT-F-12389) Avail: CFSTI CSCL 20E

The holographic method is proposed for investigations of spatial distribution of laser light field. Model experiments which confirmed the possibility of such investigations were carried out. The method is suggested to be applied for improving spatial characteristics of solid state lasers. Author

N69-34646# Bosch (Robert) G.m.b.H., Stuttgart (West Germany).
DATA RECORDING AND STORAGE BY MEANS OF LASER BEAMS [AUFZEICHNUNG UND SPEICHERUNG VON INFORMATIONEN MIT LASERSTRAHLEN]
H. Hamisch May 1969 35 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. für Wiss. Forsch.
(BMF-FB-W-69-20) Avail: CFSTI

Laser light can be focussed on a very small spot and is thus suited for space-saving fast information recording without touching the writing layer. The prerequisites for such a technique are investigated with the aim of achieving video recording. The recording is done by producing transparent regions in a thin opaque layer on a transparent base. Traces of 1.5 to 2 μm in width can be written in a bismuth layer with a velocity of 40 m/s if a 60 mW laser beam is used. A report is submitted on investigations concerning the improvement of the recording properties, the modulation of the laser beam and the scanning of recorded signals.
Author (ESRO)

N69-34683*# Techtran Corp., Glen Burnie, Md.
STUDY OF A CARBON DIOXIDE PULSED LASER [ISSLEDOVANIYE LAZERA NA CARBON DIOXIDE V IMPULSNOM REZHIME]
G. R. Levinson et al Washington NASA Aug. 1969 11 p refs Transl. into ENGLISH from Zh. Prik. Spektroskopii, Akad. Nauk Belorussk. SSR (Minsk), v. 10, no. 3, 4 Mar. 1969 p 425–432
(Contract NASw-1695)
(NASA-TT-F-12563) Avail: CFSTI CSCL 20E

Results of an investigation of a CO_2-N_2-He pulsed laser, and the study of the mechanism of inversion in a CO_2 pulsed laser are reported. The increase of peak emission power in the pulsed mode is explained by the transient processes during population of the working levels after switching in the current pulse. The effect of the gas temperature on the pulsed and continuous-mode emission limits is examined. The experimental results are in good agreement with the described qualitative model of a pulsed laser. Using a tube 3 m long and 105 mm in diameter, a pulse emission energy of 3 J was obtained with a peak power of 15 kW, and mean power of 90 W at 22% efficiency.
Author

N69-34706*# California Univ., Berkeley. Space Sciences Lab.
INTERACTION OF HIGH INTENSITY LASER RADIATION WITH METALLIC SURFACES
Giulio Varsi May 1969 149 p refs *its* Ser. 10, Issue 19
(Grant NGR-05-003-161)
(NASA-CR-103951) Avail: CFSTI CSCL 20E

Relevant aspects of the interaction between focused, pulsed laser radiation and copper or gold targets have been investigated experimentally, a phenomenological model of the process has been proposed and its validity has been shown for values of the radiation density ranging over approximately two decades. A complete literature review of over 100 papers is presented to introduce the subject of the investigation and to examine critically the experimental information reported and the models proposed. An experiment is reported for the accurate determination of the yield: the amount of material ablated by the laser radiation. A radioactive tracer technique has been employed for the measurement of the yield as a function of energy content and duration of the laser pulse.
Author

N69-34851*# Stanford Univ., Calif. Microwave Lab.
STUDY OF LASER FREQUENCY STABILITY AND SPECTRAL PURITY Final Report, 1 Mar. 1968 – 28 Feb. 1969
A. E. Siegman May 1969 90 p refs
(Grant NGR-05-020-234)
(NASA-CR-103988; SU-ML-1770) Avail: CFSTI CSCL 20E

The improvement of the short term spectral purity and the long term frequency stability of stable laser oscillators is studied. The short term frequency phase fluctuations in high quality He-Ne gas lasers were measured and for the first time, the ultimate limit on laser spectral width caused by quantum phase noise, as predicted by the Schawlow and Townes formula has been measured. The study of an absolute laser frequency stabilization method was completed, and the experimental verification is underway. A new mechanism to account for the frequency fluctuations in He-Ne 6328Å lasers was suggested, and both experimental and theoretical support were presented.
Author

N69-34852*# Stanford Univ., Calif. Microwave Lab.
OBSERVATION OF QUANTUM PHASE NOISE IN A LASER OSCILLATOR
A. E. Siegman and R. Arrathoon *In its* Study of Laser Freq. Stability and Spectral Purity May 1969 p 27–29 refs Repr. from Phys. Rev. Letters, v. 20, no. 17, 22 Apr. 1968 p 901–902 (See N69-34851 20-16)
Avail: CFSTI CSCL 20E

Quantum phase fluctuations caused by spontaneous emission were studied by heterodyning together two stable 6328Å He–Ne lasers, with one laser operating at very low power. Results are considered in agreement with the predictions of Schawlow–Townes.
Author

N69-34853*# Stanford Univ., Calif. Microwave Lab.
FURTHER MEASUREMENTS OF QUANTUM PHASE NOISE IN A He–Ne LASER
R. Arrathoon and A. E. Siegman *In its* Study of Laser Freq. and Spectral Purity May 1969 p 30–37 refs (See N69-34851 20-16)
Avail: CFSTI CSCL 20E

Extended measurements of laser frequency fluctuations, using improved instrumentation, have provided further verification of the Schawlow–Townes relation for the spontaneous-emission-limited line-width of a laser oscillator.
Author

N69-34854*# Stanford Univ., Calif. Microwave Lab.
CURRENT PUSHING OF THE OSCILLATION FREQUENCY OF A 6328 ANGSTROM He–Ne LASER
R. Arrathoon and A. E. Siegman *In its* Study of Laser Freq. and Spectral Purity May 1969 p 38–45 (See N69-34851 20-16)
Avail: CFSTI CSCL 20E

Increasing the discharge current through a small dc-excited 6328Å laser to change the index of refraction of the discharge and cause a blue shift of the laser oscillation frequency of ≈ 1 MHz/ma is studied. The shift is independent of laser cavity tuning and decreases with increasing dc discharge current. Approximate calculations plus experiments indicate that this shift represents the dispersive effects of the strong 6334Å and 6402 Å upward transitions from the neon $1s_5$ metastable level. The residual spectral width and FM noise in stable 6328 Å lasers, especially as compared to 1.15μ lasers, may be due to plasma distrubances acting through this dispersive mechanism, rather than to microphonic disturbances as commonly suggested.
Author

N69-34855*# Stanford Univ., Calif. Microwave Lab.
POSITIVE COLUMN POPULATION CALCULATIONS FOR THE EVALUATION OF DISPERSIVE EFFECTS IN He–Ne LASERS
R. Arrathoon *In its* Study of Laser Freq. and Spectral Purity May 1969 p 46–78 refs (See N69-34851 20-04)
Avail: CFSTI CSCL 20E

Sizeable shifts in the oscillation frequency of a He–Ne laser with variations in the dc discharge current have been observed. The shifting effects are believed to be due principally to changes in the populations of the helium 2^3S level and the neon $1s_5$ level. A simplified model is proposed for the approximate evaluation of these populations. A slightly modified version of the model, under regenerative conditions, is then used to evaluate the current shifting effects and the results are compared with experimental observations. The approach used is of sufficient generality to be applicable to most He–Ne lasers operating under optimum gain conditions. The results suggest that laser operation at 1.15 μ, rather than 6328 Å, may considerably reduce the effects of current variations on the oscillation frequency. For constant pressure-diameter product conditions, theory predicts that the current-shifting effects will vary approximately inversely with tube diameter. Author

N69-34872*# California Univ., Berkeley. Space Sciences Lab.
LASER SURFACE INTERACTIONS: CREATION AND DETECTION OF ATOMICALLY CLEAN SURFACES Final Report
Harold P. Smith, Jr. 31 Mar. 1969 22 p refs *Its* Space Sci. Lab. Ser. 10, Issue 7
(Grant NGR-05-003-161)
(NASA-CR-103953) Avail: CFSTI CSCL 20E

It is shown that high power Q-spoiled lasers offer an interesting method for obtaining clear surfaces in vacuum. However, complete removal of oxygen and carbon contamination from nickle surfaces by laser bombardment at 100 MW/cm^2 produced irreparable surface damage that is attributed to filamentizing of the laser beam and/or to non-uniform surface reflectivity. On the other hand, application of the technique at 30 MW/cm^2 successfully removed the (7 × 7) satellite structure from (111) silicon surfaces. Author

N69-34887# Technische Hochschule in Wien (Austria). Institut fuer Hochfrequenztechnik.
INVESTIGATIONS IN OPTICAL COMMUNICATION TECHNOLOGY (LASER) [UNTERSUCHUNGEN ZUR OPTISCHEN NACHRICHTENTECHNIK (LASER)]
G. Koepf, W. Leeb, and J. Riegl 31 Mar. 1969 45 p refs in GERMAN
Avail: CFSTI

Construction of a He 3-Ne laser for the line $\lambda = 3.39$ μm is described, and the effects of pressure and mixing ratio of the gases on the output are examined. Changes in some spectral lines of the lateral light are used to study the laser mechanism. A comprehensive presentation is given of the dependence of the discharge current on laser emission at $\lambda = 0.6328\mu$m and $\lambda = 3.39\mu$m. Another experiment deals with the current modulation of the He-Ne laser. Several modified resonator applications are examined. A system for the transmission of audio frequency signals with a CO_2 laser is described, and the development of amplifiers for two infrared detectors is briefly discussed. Transl. by K.W.

N69-34926# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
THE LASER AS A DEVICE FOR MACHINE TOOL EVALUATION
R. R. Baldwin 18 Mar. 1969 15 p refs
(Contract W-7405-eng-26)
(PB-183473; Y-DP-21) Avail: CFSTI

The laser provides a rapid and accurate method of evaluating machine tool positioning accuracy and slideway alignment; however, the laser is an asset only when with due respect to the basic principles of metrology. Author (USGRDR)

N69-35042# Forsvarets Forskningsanstalt, Stockholm (Sweden).
THE RISK OF INJURY FROM LASER RADIATION. PART 1: LIST OF LITERATURE [SKADERISKER VID LASERBESTRALNING. DEL 1. LITTERATURFOERTECHNING]
Einar Hassborn and Bjoern Tengroth Oct. 1967 14 p refs In SWEDISH
(FOA-2-C-2191-51) Avail: CFSTI

A list of 115 references to works dealing with the biological dangers of laser radiation and methods of protection is presented. Most of the listings refer to English-language works. Transl. by K.W.

N69-35043# Forsvarets Forskningsanstalt, Stockholm (Sweden).
THE RISK OF INJURY FROM LASER RADIATION. PART 2: SPECIFYING LASER DATA [SKADERISKER VID LASERBESTRALNING. DEL 2: SPECIFICERING AV LASERDATA]
Tore Bergqvist and Bengt Kleman Nov. 1967 11 p In SWEDISH
(FOA-2-C-2207-51) Avail: CFSTI

Characteristics of laser radiation are reviewed, including wavelengths, waveforms, output cross sections, divergences, and biological hazards. Data for some of the most common CW and pulsed laser types are presented in tables. Transl. by K.W.

N69-35044# Forsvarets Forskningsanstalt, Stockholm (Sweden).
RISKS OF DAMAGE FROM LASER RADIATION. PART 3: CARBON DIOXIDE LASER [SKADERISKER VID LASERBESTRALNING. DEL 3: CARBON DIOXIDE-LASER]
Britt Hartmann and Bengt Kleman Oct. 1967 10 p refs In SWEDISH
(FOA-2-C-2192-51) Avail: CFSTI

Radiation effects of CO_2 lasers in general as well as specific data obtained in experiments with dogs to study the radiation level damaging to the cornea are discussed. Some protective measures are suggested for use in work with carbon dioxide lasers. Transl. by K.W.

N69-35073# Texas Univ., Austin. Antennas and Propagation Lab.
THEORETICAL AND EXPERIMENTAL STUDY OF THE TRANSMISSION OF LASER RADIATION THROUGH WATER
Kenneth R. Hessel and Alfred H. La Grone 2 May 1969 132 p refs
(Grant NSF-GA-767)
(PB-184114; Rept-P-33) Avail: CFSTI CSCL 20F

Computer programs were developed which will give the intensity of laser radiation on a plane perpendicular to the beam at any distance from the source, for transmission through water (or any other medium) with absorption and scatterers with dimensions small compared to the path length, yet long compared to the wavelength of light. A Monte Carlo method of photon tracing is used. Author (USGRDR)

N69-35148*# Sylvania Electronic Systems-West, Mountain View, Calif. Electro-Optics Organization.
STABILIZED CW LASER SYSTEM FOR THE GENERATION OF SINGLE-FREQUENCY LIGHT Final Engineering Report, 1 Mar. 1967 - 11 Apr. 1968
Russell Targ and J. M. Yarborough 1 May 1968 31 p refs
(Contract NAS8-20558)
(NASA-CR-61419) Avail: CFSTI CSCL 20M

The results of the research, design, and development of a frequency-stabilized argon FM argon laser are summarized. The

development of an automatic frequency control system to stabilize the frequency of the FM laser with respect to the center of the 5145 Å fluorescence line is reported. An outstanding benefit of this frequency stabilization is that the axial mode beats of the FM laser are very much suppressed with beats of the free-running laser, and the laser is quieted by the elimination of the low-frequency intensity fluctuations associated with mode competition and mode pulling. Author

N69-35471# Texas Univ., Austin. Antennas and Propagation Lab.
WATER VAPOR ABSORPTION MEASUREMENTS USING A RUBY LASER
M. M. Johnson and A. H. La Grone 28 Feb. 1969 78 p refs
(Grant NSF GA-767)
(PB-183466; P-32) Avail: CFSTI CSCL 04A

Formulas are developed to show how information necessary to number density determinations can be solved for in terms of the loss in intensity of slowly diverging monochromatic radiation. Spectral characteristics pecular to the ruby laser indicate that is differs radically from the desired monochromatic source. Measurements of absorption near the 6943.8 A water vapor line using a (thermally) frequency tunable ruby laser were conducted over a 0.74 km horizontal atmospheric path. Using the absorption profiles and the temperature, pressure, and humidity over the path, calculations were made of the absorption cross sections at points of maximum absorption. Further accuracy in these measurements is deemed necessary to develop a capability for determining molecular number densities as a function of altitude. Author (USGRDR)

N69-35492# Istituto di Fisica dell'Atmosfera, Roma (Italy).
SCATTERING OF A LASER BEAM IN A FOG [SCATTERING DI UN FASCIO LASER IN NEBBIA]
R. Ferrara, G. Fiocco (European Space Res. Inst.), and G. Tonna Oct. 1968 17 p refs In ITALIAN
(IFA-SR-23) Avail: CFSTI

From an analysis of the angular distribution of a laser beam scattered by fog, the distribution of particle radii was found. A general survey of the problem is presented in this report. ESRO

N69-35599 Toulouse Univ. (France). Faculté des Sciences.
SIMULATION OF PULSED IONIZING RADIATION EFFECTS BY LASER [SIMULATION DES EFFETS DES RAYONNEMENTS IONISANTS PULSES PAR LASER]
J. Bielle *In* CERTS Determination of Radiation Doses in Space 1968 p 383-301 refs In FRENCH; ENGLISH summary (See N69-35576 20-29)
Copyright. Avail: Issuing Activity

The possibility of lasers to simulate the effects of pulsed ionizing radiation effects (nuclear bursts) on semi-conductor devices is analyzed. The advantages and disadvantages of such methods are discussed and compared to other simulation methods (linear accelerators, X-ray generators). The effects of pulses on neodymium doped lasers ($\lambda = 1.06\mu$) on silicon are discussed and some experimental results are presented. ESRO

N69-35761# Signals Research and Development Establishment, Christchurch (England).
MODULATION AND DEFLECTION OF LASER BEAMS
M. J. Dore (Ph.D. Thesis) Oct. 1968 154 p refs
(SRDE-68022) Copyright. Avail: CFSTI

The design and performance of electrooptic modulators is discussed. Comparison is made of various materials. A practical modulator using ADP is described which requires only 220V drive for 100% modulation. Its drive power requirement is of the order of 2W per MHz of bandwidth. The power requirements of both the analogue electrooptic prism and the binary digital types of laser beam deflector are treated. A novel digital multiplication deflection scheme is proposed which overcomes some of the difficulties of the analogue and binary schemes. Finally rotating mirror prisms are shown to be capable of being developed into a practical means of deflecting laser beams. Author (ESRO)

N69-35791*# Hughes Aircraft Co., Torrance, Calif. Electron Dynamics Div.
RESEARCH DIRECTED TOWARD PERFECTING A DESIGN FOR A SPACE QUALIFIED HE-NE LASER Interim Report
William P. Kolb Jan. 1969 172 p refs
(Contract NAS12-579)
(NASA-CR-86212; W-2845) Avail: CFSTI CSCL 20E

The research and development toward perfecting a space-qualified 5 mW He – Ne laser is reported. The laser and power supply, which are integrated into a single package, provide a rugged, lightweight, compact unit. The design details of the unit are presented. The laser design data are also included. The results of special studies conducted in cold cathode geometry and lifetests; internal mirrors; mirror and window seals; and environmental testing are reported. Results obtained in testing the first discharge tube of the modified design are also included. Author

N69-35917# Istituto Superiore delle Poste e delle Telecomunicazioni, Rome (Italy).
INFLUENCE OF THERMAL TURBULENCE IN A CONVECTIVE ASCENDING STREAM ON PHASE FLUCTUATIONS OF A LASER BEAM
Mario Bertolotti, Mario Carnevale, Bruno Crosignani, and Paolo di Porto Fondazione Ugo Bordoni 4 Oct. 1968 20 p refs
Avail: CFSTI

The effects of thermal turbulence on the phase fluctuations of a laser beam are investigated by means of a laboratory experiment. The artificially generated turbulent field approximates to actual outdoor conditions of propagation under near-earth conditions. Author (ESRO)

N69-35979# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Institut für Flugfunk und Mikrowellen.
ACOUSTO-OPTICAL DEFLECTION OF LASER PULSES [AKUSTO-OPTISCHE ABLENKUNG VON LASERIMPULSEN]
Friedrich Maiota *In its* DVL News, No. 39 Mar. 1969 p 446-447 in GERMAN (See N69-35976 20-34)
Avail: CFSTI

For some applications of optical radar a deflection system is needed to increase the divergence of the beam. To replace slow mechanical devices, an ultrasonic cell combined with a gas laser has been developed. ESRO

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N69-34624# California Univ., Livermore. Lawrence Radiation Lab.
ACTIVE METAL BRAZING TECHNIQUE FOR METAL-TO-NONMETAL SEALS
Richard H. Bulmer 27 Mar. 1969 9 p refs Presented at Symp. on Eng. Probl. of Fusion Res., Los Alamos, N.Mex., 8-11 Apr. 1969 Sponsored by AEC
(UCRL-71542; CONF-690407-6) Avail: CFSTI

The new Astron accelerator requires a large ceramic-metal stack assembly for the electron gun accelerating column. Vacuum-tight joining of the metal and nonmetal elements of the stack will be done by the active metal brazing technique. This technique has proved to be successful previously on smaller assemblies. In the assembly, machine copper rings are sandwiched between 15 1/2-in.-o.d. alumina rings, resulting in an 18 1/4-in.-high stack with 24 brazed joints. The assembly must be aligned within 0.015 in. and must be vacuum tight against an external pressure of 3 atm. A vacuum furnace capable of 900°C with high pumping speed in the 10^{-5} toor range is required for the brazing operation. The high pumping speed is necessary to reduce the pressure resulting from evolution of hydrogen from the titanium hydride flux used for brazing. A cold-wall furnace employing refractory metal heat shields, which was designed and built specifically for this brazing operation, is described. Author (NSA)

N69-34656# Bosch (Robert) G.m.b.H., Stuttgart (West Germany). Physikalische Lab.
A CONTRIBUTION TO THE DESIGN, PRODUCTION AND APPLICATION OF FORM-PRESSED PARTS OF METAL POWDERS [EIN BEITRAG ZUR GESTALTUNG, FERTIGUNG UND ANWENDUNG VON FORMTEILEN AUS METALLPULVER]
Johannes Kreissig *In its* Tech. Rept., Vol. 2, No. 4 Jun. 1968 p 170-176 refs In GERMAN; ENGLISH summary (See N69-34653 20-34) 00-34)
Avail: CFSTI

The design of pressed parts to be produced by powder metallurgical methods must follow certain rules to avoid high costs for labor and finishing procedures. Several examples are described and the influence of surface hardening on the sliding properties is discussed. ESRO

N69-34671*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THERMAL TREATING STUDIES ON NEW ALUMINUM ALLOY 2021
M. W. Brennecke 20 May 1969 26 p refs
(NASA-TM-X-53847) Avail: CFSTI CSCL 11F

The new high strength, heat treatable aluminum alloy 2021 was evaluated by employing sheet and plate (0.063 to 0.50" thick) from the first lot of plant-fabricated material. Tensile properties were determined for tempers produced by the manufacturer and after subjection to extensive thermal processing over the temperature range from 315°F for artificial aging, up to 995°F for solution heat treatment, and cooled at various rates. Tensile tests confirm high strengths in the heat treated and aged temper, -T8E31, as produced by the manufacturer and, -T62, as produced in these studies. Author

N69-34691# Bosch (Robert) G.m.b.H., Stuttgart (West Germany). Physikalisches Laboratorien.
SINTERING PROCESS AND RADIAL RUPTURE STRENGTH OF Fe/Sn AND Fe/Cu/Sn SINTERED SPECIMENS [SINTERVERLAUF UND RADIALE BRUCHFESTIGKEIT VON Fe/Sn- UND Fe/Cu/Sn-SINTERKOERPERN]
F. Esper, K.-H. Friese, and R. Zeller *In its* Tech. Rept., Vol. 2, No. 5 Nov. 1968 p 227-244 refs In GERMAN; ENGLISH summary (See N69-34688 20-34)
Avail: CFSTI

The change of volume of Fe/Sn and Fe/Cu/Sn specimens as a function of temperature was investigated by means of a dilatometer. The breaks in the dilatometer curve coincide with temperatures characterized by phase transitions, as shown by X-ray diffraction and metallographic examination. From the dilatometer curve and the phase diagram of the particular system, a comprehensive interpretation of the sintering reaction can be given. From this, it is possible to explain the radial compressive strength, the tensile strength and the hardness of the specimens. Author (ESRO)

N69-34701# ITT Research Inst., Chicago, Ill.
RESEARCH ON ZIRCALOY BRAZE ALLOY DEVELOPMENT, 1 JANUARY - 31 MARCH 1969
18 Apr. 1969 21 p Sponsored jointly by US-EURATOM
(Contract AT(11-1)-578)
(IITRI-578-P-29-35; EURAEC-2101) Avail: CFSTI

Brazed specimens of Zircaloy, which were exposed to hydro-dynamic testing for a full 3000 hr period in the boron shimmed loop with lithium hydroxide for pH control, were evaluated on the basis of visual appearance, weight change, mechanical properties, and metallographic examinations. A new series of 170 brazed samples, representing 17 selected brazing alloys plus control specimens, were prepared, and exposure was inititated in the ammonia controlled loop. Author (NSA)

N69-34704*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF STRESS RATIO ON FATIGUE-CRACK GROWTH IN 7075-T6 AND 2024-T3 ALUMINUM-ALLOY SPECIMENS
C. Michael Hudson Washington Aug. 1969 31 p refs
(NASA-TN-D-5390) Avail: CFSTI CSCL 11F

Axial load fatigue crack growth tests were conducted on 12 inch-wide sheet specimens made of 7075-T6 and 2024-T3 aluminum alloy. These tests were made at stress ratios R (ratio of the minimum stress to the maximum stress) ranging from -1.0 to 0.8 and at maximum stress levels ranging from 5 to 50 ksi to study the effects of stress ratio on fatigue crack growth. The experimental results were analyzed by using the stress intensity method. For a given positive stress ratio, the fatigue crack growth rate was a single valued function of the stress intensity range for both 7075-R6 and 2024-T3 aluminum alloys. For $R \geq 0$ the crack growth rates varied systematically with R for both materials; the higher stress ratios produced higher rates of fatigue crack growth for a given stress intensity range. Fatigue cracks in the 7075-T6 aluminum alloy grew at the same rates in all tests with $R \leq 0$ when the same maximum stress intensity factor was applied. In contrast, fatigue cracks in the 2024-T3 aluminum alloy grew faster in the tests with $R = -1$ than in the tests with $R = 0$ when the same maximum stress intensity factor was applied. Empirical equations previously developed by various investigators were fitted to the experimental data. In general, good correlation was obtained. Author

N69-34820# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
ULTRASONIC NONDESTRUCTIVE MEASUREMENT OF IRRADIATION DAMAGE IN STEEL

D. O. Hunter 18 Nov. 1968 20 p refs Presented at Metals Eng. Natl. Conf., Washington, D.C.
(Contract AT(45-1)-1830)
(BNWL-SA-2207; CONF-690318-1) Avail: CFSTI

The feasibility of ultrasonic methods for measuring radiation damage manifested by embrittlement in low alloy steels and loss of ductility in austenitic steels was investigated. Steels tested included ASTM A302B used in reactor pressure vessels, ASTM A542 B considered for pressure vessel use, and AISI 304 austenitic stainless steel proposed for use in fast flux reactors. Results showed that changes in velocity were a principle cause of the change in critical angle method signal. It is probable that a relationship can be established between the ultrasonic critical-angle response and the shift in nil ductility-transition temperature if the irradiation temperature is known. Ultrasonic response to damage in 304 stainless steel is similar to that in low alloy steel. It appears that ultrasonic testing methods are useful laboratory tools to study radiation damage and recovery for polycrystalline alloys. NSA

N69-34821# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
ULTRASONIC VELOCITIES AND CRITICAL-ANGLE-METHOD CHANGES IN IRRADIATED A302-B AND A542-B STEELS
D. O. Hunter Apr. 1969 160 p refs
(Contract AT(45-1)-1830)
(BNWL-988) Avail: CFSTI

Ultrasonic critical-angle-method amplitude changes and ultrasonic shear and longitudinal velocity changes are measured on reactor irradiated A302-B and A542-B low alloy steels. For specimens irradiated at temperatures between 140 and 350°F, shear velocity decreased from about 0.2% at 1.5×10^{18} nvt to 0.6% at 1 to 2×10^{20} nvt. Longitudinal velocity decreased from 0.1% to 0.3% at similar fluences. Measurements of velocities changes for specimens irradiated at temperatures between 610 and 680°F were inconclusive due to the small changes. There were indications, however, that high temperature irradiated specimens had experienced increased velocities before decreasing velocities trends were established. Critical angle amplitude changes are generally comparable to velocities changes. Possible radiation damage and recovery mechanisms are discussed along with their possible effects on elastic constants. Measurements methods and apparatus are described. Author (NSA)

N69-34889# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
CHEMICAL MILLING OF BERYLLIUM
R. C. Anderson and R. L. Ludwig 8 Mar. 1968 11 p
(Contract W-7405-eng-26)
(Y-1612) Avail: CFSTI

Chemical milling of beryllium ingot sheet was investigated as an inexpensive, alternate method for producing the radiative fins for the SNAP-27 Radioisotope Thermoelectric Generator. Fin specimens were submerged in a sulfuric acid bath maintained at a constant temperature, then slowly rotated while being withdrawn from the bath at a constant rate of speed. This procedure should have produced uniformly tapered fins within a reasonable length of time. However, there were variations in the taper due to the nonuniform thickness of the hot-rolled beryllium sheet and a preferential attack at the rolling defects in the beryllium sheet. Author (NSA)

N69-34874# Naval Research Lab., Washington, D.C. Metallurgy Div.
INTEGRATION OF METALLURGICAL AND FRACTURE MECHANICS CONCEPTS OF TRANSITION TEMPERATURE FACTORS RELATING TO FRACTURE-SAFE DESIGN FOR STRUCTURAL STEELS
W. S. Pellini and F. J. Loss 22 Apr. 1969 74 p refs
(AD-688417; NRL-6900) Avail: CFSTI CSCL 11/6

The report presents interpretations of the relationships between micromechanical and macromechanical ductilities, a broad survey of the evolution of the various aspects of transition temperature concepts, and a summary of recent research which has clarified the constraint-effects issue. As an essential part of the background survey, the basic aspects of micromechanical fracture processes are described in an abridged form. An introduction to the elementary aspects of fracture mechanics theory, for purposes of this report, is provided. Author (TAB)

N69-34878# Mitsubishi Heavy-Industries, Ltd., Tokyo (Japan).
BRITTLE FRACTURE CHARACTERISTICS OF NEW MITSUBISHI BAINITIC STEEL
Kazuhisa Suzuki Jun. 1969 12 p refs *Its* Mitsubishi Tech. Bull. No. 58
Avail: CFSTI

The results of the Charpy-V notch and press notch impact tests are reported for brittle fracture in a new type of steel. Included are ESSO tests with temperature gradients for arresting brittleness, NRL type drop weight tests, and explosion tests. This steel was developed to be used for high tensile steel welded structures which would be subjected to explosive loads. Author

N69-34890# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
STRUCTURE OF AN AMORPHOUS FePC ALLOY
S. C. H. Lin and Pol Duwez Feb. 1969 22 p refs
(Contract AT(04-3)-221)
(CALT-22-63; PB-183102) Avail: CFSTI CSCL 11F

The structure of an amorphous Fe80-P13-C7 alloy obtained by rapid quenching from the liquid state has been studied by X-ray diffraction. An analysis of the radial distribution function indicates that the number of nearest neighbors is approximately seven at a distance of 2.6 A. The structure of the alloy is tentatively described as a random network of trigonal prisms similar to those found in the crystalline phase Fe2P in which the iron atom has a ligancy of seven. Author (USGRDR)

N69-34905# United Kingdom Atomic Energy Authority, Harwell (England). Applied Chemistry Div.
POST-TRANSITION CORROSION OF ZIRCALOY-2, LOW-NICKEL ZIRCALOY-2 AND ZIRCALOY-4 BY STEAM AT 300 DEG C AND 340 DEG C: DEUTERIUM ABSORPTION AND THE INFLUENCE OF HEAT TREATMENT
J. R. Findlay, C. F. Knights, and R. Perkins Nov. 1968 19 p refs
(AERE-R-5903) Avail: CFSTI; HMSO: 3s

The rates of corrosion and deuterium absorption of the alloys were compared at 300 and 340°C in D_2O steam at approximately 100 mg dm^{-2} weight gain. The post-transition region was reached by pre-oxidation in H_2O steam at 450°C followed by a prolonged exposure at the lower temperature until the rate of reaction became constant. On the basis of corrosion behavior the alloys can be divided into two groups. The alloys of group I, beta-quenched Zircaloy-2 and low-nickel Zircaloy-2, showed identical

corrosion behavior and had a lower deuterium absorption rate but a higher oxidation rate than alloys of group II (alpha-annealed Zircaloy-2, low-nickel Zircaloy-2 and Zircaloy-4 and beta-quenched Zircaloy-4). The latter alloys showed similar corrosion behavior, with a few exceptions. The presence of beta-quenched Zircaloy-4 with the alpha-annealed alloys is a reflection of the fact that the corrosion behavior of Zircaloy-4 was insensitive to heat-treatment.
Author (NSA)

N69-34816*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE INFLUENCE OF CRACK LENGTH AND THICKNESS IN PLANE STRAIN FRACTURE TOUGHNESS TESTS
Melvin H. Jones and William F. Brown, Jr. Washington Aug. 1969 30 p refs
(NASA-TM-X-1880) Avail: CFSTI CSCL 11F

It is shown that K_{Ic} values determined in accordance with the present ASTM E-24 proposed test method for plane strain fracture toughness of metallic materials can vary moderately within the specimen size and geometric limitations imposed by the test method. The magnitude of these variations will depend on the material properties and would be increased by relaxation of the size requirements. The possibility of employing subsized specimens for screening materials regarding their plane strain fracture toughness was explored as well as several methods for relating these values to uniaxial tensile data.
Author

N69-34932# General Electric Co., Schenectady, N.Y. Knolls Atomic Power Lab.
LIMITATIONS OF THE LINEAR POLARIZATION TECHNIQUE IN EVALUATING CORROSION BEHAVIOR
M. E. Indig and C. Groot 1968 18 p refs
(Contract W-31-109-eng-52)
(PB-183105; KAPL-P-3475) Avail: CFSTI CSCL 11F

Current, potential, and weight losses were measured on a system consisting of a stainless steel working electrode, a platinum black reference and auxiliary electrodes. The electrolyte was slightly alkaline lithiated water containing 3 ppm hydrogen at 288C and at saturation pressure. Linear polarization measurements were made in the region 0.20 millivolts from the open circuit potential. A corrosion current was calculated from these measurements, using previously cited Tafel constants (B.E. Wilde). The cathodic Tafel constant was also measured directly.
Author (USGRDR)

N69-35019# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
VACUUM COATING OF BORON NITRIDE
Robert G. Kurtz and T. Van Vorous 18 Apr. 1969 8 p refs
(Contract AT(29-1)-1106)
(RFP-972) Avail: CFSTI

A method has been developed to deposit adherent metal films on boron nitride. The procedure utilizes thin (about 500 angstroms) film of beryllium deposited by ion plating techniques directly onto the boron nitride. Films of other metals may then be deposited over the beryllium film by any convenient method. Thorough substrate cleaning and outgassing prior to the start of the deposition process are essential for good film adherence, as well as substrate heating before and during the deposition.
Author (NSA)

N69-35133*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
GALVANIC CORROSION AND CATHODIC PROTECTION; SELECTIVE BIBLIOGRAPHY
23 Jan. 1969 61 p refs
(NASA-TM-X-61780; GP-625) Avail: CFSTI CSCL 11F

A bibliography with abstracts is presented which includes references to periodical articles and reports. The material was compiled from *Chemical Abstracts* 1963-68, *Corrosion Abstracts* 1963-68, *Engineering Index* 1963-68, a 1968 Defense Documentation Center bibliography, and a NASA bibliography covering 1962-67. Most of the listed works deal with galvanic corrosion and cathodic protection.
K.W.

N69-35269# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
HYDROGEN-INDUCED PHASE TRANSFORMATIONS IN TYPE 304 L STAINLESS STEELS
M. L. Holzworth and M. R. Louthan, Jr. 21 Jun. 1968 31 p refs
(Contract AT(07-2)-1)
(PB-183563; DP-MS-67-107) Avail: CFSTI CSCL 11F

Electrolytic charging of hydrogen into Type 304L stainless steel at room temperature and 100C induced partial transformation of the austenite to the same martensitic phases (alpha (bee) and epsilon (hep) as are formed by cold-working hydrogen-free austenite at low temperatures (-196C). No evidence of a hexagonal hydride was found. The formation of the epsilon phase by cathodic charging suggests that hydrogen lowers the stacking fault energy of austenite. Hydrogen charging expands the austenite lattice, causes the dislocation and stacking fault density to increase with increasing hydrogen concentration, and causes dislocation movement.
Author (USGRDR)

N69-35273# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials
KONDO EFFECT IN AMORPHOUS PALLADIUM-SILICON ALLOYS CONTAINING TRANSITION METALS
C. C. Tsuei and R. Hasegawa Jan. 1969 22 p refs
(Contract AT(04-3)-221)
(CALT-221-82; PB-182552) Avail: CFSTI CSCL 20L

The report gives results of measurements of the electrical resistivity of amorphous palladium-silicon alloys containing Cr, Mn, Fe or Co as a function of temperature and of alloy concentration. These results and those of a limited number of magnetic susceptibility and magnetoresistance measurements are analyzed in terms of the Kondo theory of s-d exchange interaction. Evidence is presented to show that in some of the amorphous alloys it is possible that ferromagnetism coexists with Kondi-type logarithmic temperature divergence of resistivity.
USGRDR

N69-35418# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TECHNICAL PROGRESS IN INGOT CASTING OF LIGHT ALLOYS
V. Dobatkin 29 Mar. 1968 26 p refs Transl. into ENGLISH from Tsvetn. Metal. (Moscow), v. 40, no. 10, 1969 p 47-51
(AD-678807; FTD-HT-23-144-68) Avail: CFSTI CSCL 11/6

This survey covers 18 Soviet works on the ingot casting of light alloys, including continuous casting of aluminum and magnesium alloys, vacuum arc melting with an expendable electrode, vacuum arc slag melting, and electroslag melting.
Author (TAB)

N69-35514*# Pratt and Whitney Aircraft, East Hartford, Conn.
TESTING OF HIGH-EMITTANCE COATINGS
R. E. Cleary and C. Ammann Washington NASA Aug. 1969 113 p refs
(Contract NAS3-10609)
(NASA-CR-1413) Avail: CFSTI CSCL 11F

Three coatings were applied to the platinum -20 wt.% rhodium alloy substrate by plasma spraying at a temperature of 1000±50°F. These coatings were hafnium oxide, cerium oxide, and iron titanate. The hafnium oxide was also applied chemically by the vapor deposition process. Initially, emittance testing of the plasma-sprayed coatings for 200 hours at 2100°F in a vacuum of 1×10^{7} torr or better disclosed these values for total hemispherical emittance: hafnium oxide, 0.51 to 0.64; cerium oxide, 0.87 to 0.91; iron titanate, 0.94. The emittance of the chemically vapor deposited hafnia was 0.63 to 0.71. The coatings were aged in air for 1500 hours at 1100°F. They were subsequently tested in vacuum at temperature of about 2100°F. The emittance was cerium oxide, 0.86 to 0.91; iron titanate, 0.90; hafnium oxide, 0.74 to 0.75. The cerium oxide coating was also tested for 2000 hours at 2100°F in a vacuum of 1×10^{-7} torr or better with an emittance of 0.85 to 0.93. Author

N69-35547# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DEEP DRAWING OF MOLYBDENUM AND ITS ALLOYS
V. N. Korolev et al 14 Jan. 1969 24 p refs Transl. into ENGLISH from Kuznechno-Shtampovochnoe Proizv. (USSR), v. 9, no. 10, 1967 p 17–23
(AD-687631; FTD-HT-23-1089-68) Avail: CFSTI CSCL 11/6

The effect of various technological factors on the capacity for deep drawing of commercial-grade sintered molybdenum and TaM-2 and Vm-1 molybdenum alloys has been investigated on flat specimens, 6mm wide and 0.5 and 0.8mm thick, cut from rolled sheets in the direction alone, and/or transverse, or at a 45 deg. angle to the direction of rolling. Test specimens in the annealed or strain-hardened condition were tested for mechanical properties under conditions of uniaxial and biaxial tension at temperatures of up to 500C. Except for recrystallized sheet, the NDT temperature of all the investigated material was below room temperature. This showed that satisfactory parts can be produced from them by drawing at room temperature. The capacity for deep drawing depended mainly on the content of impurities, the microstructure and the deformation rate. Heating to 100-120C significantly decreased the susceptibility to exfoliation and cracking and appreciably extended the technological use of the investigated metals. The capacity of sheet molybdenum for deep drawing increased with increasing prestraining at cold or warm rolling. The experimental results showed also the feasibility of progressive multioperation deep drawing of thin wall parts from molybdenum and molybdenum-alloy sheets, with or without intermediate stress relieving. Depending on the sheet thickness, the direction of rolling and the heat treatment prior to drawing, the optimum temperature of drawing was within 220 to 350C. TAB

N69-35652*# Ohio State Univ., Columbus.
STATISTICAL THEORY OF THE INHOMOGENOUS ELECTRON GAS
John R. Smith (Ph.D. Thesis) 1968 73 p refs Sponsored by NASA
(NASA-CR-105359) Avail: CFSTI CSCL 11F

The total electron work function on bare metal surfaces is considered in two parts, the first depending on bulk properties of the metal, and the second representing the effect of the electrical double layer formed at the surface. The alkali metals, the noble metals, magnesium, aluminum, and selected transition metals are studied. A self-consistent calculation of the electron work function for these metals is presented. Electron number density distributions and the potential energy of an electron in the Fermi distributions are computed and plotted for the surface region. The method used is the statistical theory of an inhomogeneous electron gas. F.O.S.

N69-35684# Juanta de Energia Nuclear, Madrid (Spain). Metallurgy Div.
STUDY OF THE WELDING OF ZIRCALOY-2 [ESTUDIO DE LA SOLDADURA DE ZIRCALOY-2]
R. Rodriguez-Solano and J. M. Jimenez Morvno 1968 25 p refs In SPANISH; ENGLISH summary
(JEN-200-DMe/I-20) Avail: CFSTI

After a bibliographical analysis of the zircaloy-2 properties its welding is discussed. The selected procedure is the TIG (Tungsten Inert Gas) d.c. arc-welding under an inert atmosphere vessel. A detailed description of the equipment and characteristics is given. During the tests two types of argon were used: one with 96 ppm. impurities, the other with 7 ppm. impurities. The welding in helium atmosphere is also mentioned. The contamination of the welding was evaluated through hardness testing. Author (ESRO)

N69-35688*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CRYOGENIC FRACTURE PROPERTIES OF THIN AISI 301 60-PERCENT COLD-REDUCED SHEET AT VARIOUS ANGLES TO THE ROLLING DIRECTION
Frederick D. Calfo Washington Sep. 1969 25 p refs
(NASA-TN-D-5413) Avail: CFSTI CSCL 11F

Fracture properties at various angles to the rolling direction in 0.022-in (0.056-cm-) thick AISI 301 60-percent cold-reduced stainless-steel sheet were determined. Specimens 3, 6, and 12 in. (7, 6, 15, 2, and 30.5 cm) wide were tested at -423° -320°, and 70°F. A gradual increase in yield and ultimate strengths was noted at all test temperatures as specimen orientation approached the transverse direction. Net fracture strength reductions of as much as 34 percent of the room temperature values were noted at cryogenic temperatures as the orientation of the cracked specimens approached the transverse direction. Author

N69-35715# Michigan Univ., Ann Arbor. Dept. of Mechanical Engineering.
ASTM ROUND-ROBIN TEST WITH VIBRATORY CAVITATION AND LIQUID IMPACT FACILITIES OF 6061-T 6511 ALUMINUM ALLOY, 316 STAINLESS STEEL, AND COMMERCIALLY PURE NICKEL
C. Chao, F. G. Hammitt, C. L. Kling, and D. O. Rogers Nov. 1968 87 p refs Supported in part by Mich. Mem. Phoenix Proj.
(Grant NSF GK-1689)
(MMPP-344-3-T; PB-183581) Avail: CFSTI CSCL 06F

Results are discussed of a test program to study the differences, or similarities, in cavitation or impingement damage data obtained by 12 laboratories using ostensibly the same procedures and testing the same materials. The data from the reporting laboratories are represented on various damage or damage rate vs. time curves. Although all the laboratories rank the materials in the same order, when data on one material from different laboratories are plotted together, a very substantial spread is found. Detailed examination of the test procedures indicate those differences largely responsible for significant differences in test results. USGRDR

N69-35764*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RECENT DEVELOPMENTS IN CHROMIUM AND CHROMIUM ALLOYS
William D. Klopp Washington Sep. 1969 28 p refs
(NASA-TM-X-1867) Avail: CFSTI CSCL 11F

Recent developments in chromium pertinent to its potential use in advanced jet engines are reviewed. Although chromium has a strength-to-density advantage over nickel, its inherent brittleness and furthe embrittlement by nitrogen during high temperature exposure are serious limitations to its use. Twelve chromium alloys are currently under development, the strongest showing a potential 150° F (83 K) service temperature advantage over nickel-base superalloys. However, a better balance between solution strengthening and precipitate strengthening must be achieved in order to improve the low temperature ductility of these alloys. Improved coatings for protection against nitrogen embrittlement must be developed. Author

N69-35775# Boeing Co., Renton, Wash. Commercial Airplane Div.
THE TENSILE, FRACTURE TOUGHNESS, AND STRESS CORROSION PROPERTIES OF VACUUM MELTED (300) MARAGING STEEL
C. S. Carter Apr. 1969 16 p refs
(AD-688858; D6-23888) Avail: CFSTI CSCL 11/6

The tensile, fracture toughness, and stress corrosion characteristics of a vacuum melted 3 inch square billet have been determined. The tensile ultimate strength was in the range 295-300 ksi. The stress corrosion crack velocity was an order of magnitude less than in 4340M. Author (TAB)

N69-35832*# National Bureau of Standards, Boulder, Colo. Cyrogenics Div.
CRYOGENIC THERMOCOUPLE TABLES
Larry L. Sparks, Robert L. Powell, and William J. Hall Jul. 1968 64 p refs
(NASA Order R-45)
(NASA-CR-105430; NBS-9712) Avail: CFSTI CSCL 11F

Experimental tests between 4 and 280 K have been completed on the following thermocouple materials: Chromel, copper, normal silver, platinum, silver-28 at.% gold, constantan, Alumel, and gold-(0.02, 0.03, 0.07) at.% Fe. Many thermocouple combinations can be made from the above materials; the four most important being copper vs constantan, Chromel vs constantan, Chromel vs Alumel, and Chromel vs gold-0.07 at.% iron. Results of the last combination are of particular interest for measurements near liquid hydrogen temperatures. The calibration cyrostat is described briefly. Special methods of measurement and data analysis were designed to study and minimize systematic errors. Simple illustrations of these measurement schemes are given. Interim tables and graphs of the thermoelectric voltage and thermopower are given for the four combinations listed above. Author

N69-35836*# Aztec School of Languages, Inc., Maynard, Mass.
HIGH TEMPERATURE OXIDATION PROTECTION OF TUNGSTEN
V. Ye. Ivanov et al Washington NASA Aug. 1969 132 p refs Transl. into ENGLISH of the book "Zashchita Volframa ot Okisleniya pri Vysokikh Temperaturakh" Moscow, "Atom" Press, 1968
(Contract NASw-1692)
(NASA-TT-F-583) Avail: CFSTI CSCL 11F

This book is intended for specialists in the field of high-temperature materials and protective coatings. The book reviews achievements in the field of protection of tungsten and its alloys from high-temperature gaseous corrosion. Particular attention is paid to corrosion- and heat-resisting coatings. The behavior of various coatings, the materials and methods used for their production, as well as the physicochemical mechanism of their formation and protective action are examined. The authors also analyze the possible utilization of tungsten as a high-temperature structural material, the oxidation of tungsten at high temperatures, and recent achievements in the development of refractory and corrosion-resistant tungsten-base alloys. Author

N69-35879# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Physics.
ELECTRONIC SPECIFIC HEAT OF NOBLE AND TRANSITION METAL ALLOYS Final Report, 1 Feb. 1965–30 Jun. 1969
John A. Rayne 30 Jun. 1969 8 p refs
(Grant AF-AFOSR-870-65)
(AD-688886; AFOSR-69-1351TR) Avail: CFSTI CSCL 20/12

This report gives details of the principal experiments involving low temperature heat capacity measurements on platinum, bismuth telluride and silver-gold alloys. Author (TAB)

N69-35892# Stanford Univ., Calif. Microwave Lab.
PSEUDOPOTENTIAL FORM FACTORS FOR COPPER, SILVER, AND GILD
John A. Moriarty Aug. 1969 27 p refs Submitted for publication
(Grant NSF GP-8775)
(SU-ML-1779) Avail: CFSTI

Using the generalized pseudopotential formalism given by Harrison, form factors have been calculated for copper, silver, and gold at both liquid and solid densities. All quantities entering in the form factors have been calculated from first principles, including the position of the d-resonance. The full non-local character of both the ordinary pseudopotential terms and the additional hybridization terms is included without approximation. To first order, the orthogonalization hole has also been treated exactly. The Kohn-Sham approximation is used for the conduction band-core exchange, while exchange among conduction electrons is included through a modified dielectric function. The calculated form factors are used to estimate the band gap at the L point and to calculate the resistivity of the liquid metal with good results. It is expected that the form factors will be useful in further calculations of the electronic properties of the noble metals. Author

N69-35894# Commissariat a l'Energie Atomique, Paris, (France).
ELECTRON MICROSCOPE STUDIES OF THE PHENOMENON OF CORROSION CAUSED BY LIQUID SODIUM AT 600 DEG C ON AUSTENITIC STAINLESS STEEL AND ALLOYS OF NICKEL [ETUDES AU MICROSCOPE ELECTRONIQUE DE PHENOMENES DE CORROSION PROVOQUES PAR LE SODIUM LIQUIDE A 600 DEG C SUR LES ACIERS INOXYDABLES AUSTENITIQUES ET LES ALLIAGES DE NICKEL]
R. Gross et al 13 Dec. 1968 19 p refs Transl. into FRENCH from Werkstoffe Korrosion (Weinheim), no. 18, 1967 p 777–782 In FRENCH and GERMAN
(CEA-tr-A-1965) Avail: AEC Depository Libraries

Corrosion of the surfaces of a metal cylinder was examined using an electron microscope. Observations showed that corrosion is an interaction of the processes of dissolution and precipitation. The sodium dissolved the metal from the surfaces, and the metal was precipitated into the grain boundaries and on the grain surfaces. Analysis of these precipitants showed that they had previously been part of the surrounding metal. NSA

N69-35951*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EFFECT OF VACUUM ON MATERIALS
Henry E. Frankel Paris ESRO Jan. 1969 49 p refs
(NASA-TM-X-61789; ESRO-TN-77) Avail: CFSTI CSCL 11C

Most of the parameters of the space environment are the same as those of terrestrial environments, except that the former are generally more severe. However, in space a new condition is imposed: a vacuum. The degradative effects of this alien condition on metals, alloys, lubricants, ceramics, coatings, thin films, and polymeric systems are discussed. In some instances, a vacuum environment can be extremely beneficial to systems, so that a component can be designed to take advantage of the environment. Methods of prevention of premature failure in a space environment, as well as proper testing, are also presented. ESRO

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N69-34685# Bosch (Robert) G.m.b.H., Stuttgart (West Germany). Entwicklung Kunststoffe.
FREQUENCY AND TEMPERATURE INFLUENCE ON VIBRATIONAL ENERGY LOSSES IN PLASTICS [FREQUENZ- UND TEMPERATUREINFLUSS AUF DEN VERLUST AN SCHWINGUNGSENERGIE IN KUNSTSTOFFEN]
Adof Mandel *In its* Tech. Rept., Vol. 2, No. 4 Jun. 1968 p 164–169 refs In GERMAN; ENGLISH summary (See N69-34653 20-34)
Avail: CFSTI

The damping efficiency of damping blocks used in machine installations depends on the vibrational frequency, the molecular structure of the material and the operating temperature. The interdependence of dielectric and mechanical relaxation, the loss maxima dependence on frequency, and the activation energy are discussed. ESRO

N69-34690# Bosch (Robert) G.m.b.H., Stuttgart (West Germany). Physikalisches Laboratorien.
PLASMA-SPRAYED ELECTRICALLY INSULATING CERAMIC COATING [PLASMAGESPRITZTE, ELEKTRISCH ISOLIERENDE KERAMIKSCHICHTEN]
Kuno Kirner *In its* Tech. Rept., Vol. 2, No. 5 Nov. 1968 p 220–226 refs In GERMAN; ENGLISH summary (See N69-34688 20-34)
Avail: CFSTI

Plasma-spraying enables metals, graphite and other conductors to be coated with an electrically insulating coating. The oxide ceramic materials used for this purpose are described and their range of applications is illustrated by several examples. The main advantages of ceramic coatings are the realization of electrical insulation at high temperatures combined with good thermal conductivity, no restrictions on the shape of the body to be insulated, and the possibility of local insulation. ESRO

N69-34708*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MOLECULAR ORIENTATION AND MECHANICAL ANISOTROPY IN POLYETHYLENE, POLYPROPYLENE, AND POLY(ETHYLENE TEREPHTHALATE) FILMS
Howard L. Price Washington Aug. 1969 21 p refs Presented at Silver Anniv. Tech. Conf. of the Soc. of Plastics Engr., Detroit, May 1967 Submitted for publication
(NASA-TN-D-5380) Avail: CFSTI CSCL 11I

Sonic pulse velocity measurement of the molecular orientation in polyethylene, polypropylene, and poly(ethylene terephthalate) films are presented. The orientation is correlated with the tensile properties which were measured at several angles in the plane of the film. The mechanical anisotropy is shown by the variation of the tensile properties and the stress relaxation modulus with direction in the plane of the film. Author

N69-34719*# Washington Univ., Seattle. Ceramic Engineering Div.
MULTIDISCIPLINARY RESEARCH ACTIVITY ON THE NATURE AND PROPERTIES OF CERAMIC MATERIALS Semiannual Status Report, 16 Dec. 1968 – 15 Jun. 1969
James I. Mueller 15 Jun. 1969 39 p refs
(Grant NGL-48-002-004)
(NASA-CR-103950; SASR-12) Avail: CFSTI CSCL 11B

Chemical, mechanical, atomic and molecular, and processing aspects were studied in connection with energy environment effects on ceramics. Chemical research included studies on gas –solid and solid –solid equilibrium, interstitial compounds, zirconium oxidation, and calorimetry. Mechanical properties studies were directed towards crystalline ceramics and included aluminum oxide bicrystals and zirconium-carbon coatings. Atomic and molecular research was concerned with the effects of radiation on ceramic materials, the domain dynamics in isomorphous ferroelectrics, applications of the Mossbauer effect, and the impurity diffusion in MgO under the influence of an electric field. Processing studies were directed towards obtaining information on processes used for fabricating ceramics and to correlate characteristics of particles and agglomerates with forming and subsequent product properties. D.L.G.

N69-34750# Naval Research Lab., Washington, D.C. Organic and Biological Chemistry Branch.
FIRE RETARDANT PAINT SYSTEMS FOR NUCLEAR SUBMARINE INTERIORS Final Report
T. R. Walton May 1969 24 p refs
(AD-688413; NRL-6886) Avail: CFSTI CSCL 11/3

The navy needs a fire-retardant paint for submarine interiors that will release little or no toxic materials into the atmosphere during and after application. The paint should possess good leveling properties so that an attractive surface free of brush marks is obtained, should have a short drying time, and should show good freeze-thaw stability. The dry film should be flexible, should possess good hiding power, and should have a 60 degree gloss between 35 and 50%. A water-based coating system has been developed that should meet these requirements. Such a coating system consists of a fire-retardant undercoat and a decorative topcoat. The topcoat alone is combustible, but when used in combination with the fire-retardant undercoat, the complete system is self-extinguishing. Although the system will burn when exposed to an extraneous flame or fire, the burning film will immediately self-extinguish when the ignition source is removed or when that part of the film exposed to the fire is consumed. Author (TAB)

N69-34760# Army Dept., Washington, D.C.
AIRCREW PROTECTIVE SYSTEMS
Thomas E. Sullivan *In* AGARD Pattern Recognition. Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 14 p (See N69-34751 20-04)
Avail: CFSTI

The development of armor materials, especially reinforced plastic-ceramic composite armor, for protection of men and equipment against small arms fire and shell fragments is discussed. Emphasis is placed on the application of these materials to aircraft, particularly rotary wing aircraft. Each armor component is identified, and the production of the woven-roving glass fabric laminate and its assembly into the composite is described. Since the main purpose of body armor is to reduce casualties, the basic scope of a battle casualty survey is discussed, and the results of wound ballistic studies are reported. The psychological affects of the use of body armor in combat are also described. Illustrations of current applications of armor for helicopter crewmen and helicopter components in Southeast Asia are shown. Author

N69-34889# Sandia Corp., Albuquerque, N.Mex. Physical Metallurgy Div.
DYNAMIC FRACTURE OF FILAMENT-REINFORCED METAL-MATRIX COMPOSITES
R. P. Reed and D. M. Schuster Mar. 1969 31 p refs
(SC-DR-69-150; PB-183558) Avail: CFSTI CSCL 11D

The dynamic fracture of filament reinforced metal matrix composites was investigated using the thin flyer plate technique. Aluminum alloys, containing approximately 50 volume percent boron filaments arranged in two mutually perpendicular directions, were impacted normal to the plane of reinforcement with 0.01 inch thick mylar flyers to induce spall fracture and filament damage. Filament damage, in the form multiple fiber fractures or crushing, tended to increase with impact velocity. Spall failure and filament damage appeared to be mutually independent. Author (USGRDR)

N69-35171# Tokyo Univ. (Japan). Inst. of Industrial Science.
GLASS-FORMATION RANGES OF TERNARY SYSTEMS. PART 2: GERMANATES OF A-GROUP ELEMENTS
Minoru Imaoka and Toshiko Yamazaki Jun. 1969 39 p refs In ENGLISH and JAPANESE *Its* Vol. 19, No. 3, Serial No. 122
Avail: CFSTI

The glass formation data of the germanate system of A group elements are presented. The composition of the melts is usually described by mixture composition or corrected by their volatility calculated from the mixing loss. Experimental results were judged by naked eye and given in table form. G.G.

N69-35278# Army Foreign Science and Technology Center, Washington, D.C.
COMPOSITION AND PERFORMANCE PROPERTIES OF HEAT RESISTANT COATINGS
A. A. Appen 7 Mar. 1969 49 p Transl. into ENGLISH from the Publ. "Temperaturoustoichivii Neorganicheskie Pokrytiya" USSR, 1967 p 107–147
(AD-688386; FSTC-HT-23-98-68) Avail: CFSTI CSCL 11/2

The requirements for, and the types of, long-term and short-term heat resistant coatings are discussed from the standpoint of their composition and performance. Particular attention is given to aluminum coatings. Author (TAB)

N69-35313# Owens-Corning Fiberglas Corp., Granville, Ohio.
AEROSTRAND
J. L. Kane *In* AFCRL Tethered Balloon Workshop Mar. 1968 p 115–122 (See N69-35301 20-02)
Avail: CFSTI

Aerostrand is a glass fiber-epoxy resin tension member. It was made in monostrand form having breaking loads up to 3,000 lb. The breaking length of Aerostrand is approximately 340,000 ft as compared to approximately 153,000 ft for the nearest competitive material. The physical and mechanical properties of Aerostrand, which were determined, are given. A method of terminating and splicing the material is explained. Author

N69-35315# Monsanto Research Corp., Dayton, Ohio.
GLASS-EPOXY COMPOSITE CABLES FOR TETHERED BALLOONS
G. L. Hanna *In* AFCRL Tethered Balloon Workshop Mar. 1968 p 129–135 (See N69-35301 20-02)
(Contract F33615-67-C-1315)
Avail: CFSTI

The 3/16-in. diam Glastran (a glass-epoxy composite) and steel cables were tensile tested to determine the breaking load and strength-to-weight ratio for each material. The absolute breaking load for the Glastran (4040 lb) was comparable to that of the steel (4270 lb). However, the strength-to-weight ratio of the Glastran was approximately three times that of the steel. Both materials were endurance tested over pulley-to-cable diameter ratios of 40:1 and 30:1. Subsequent tensile tests which indicated a degradation in strength resulted only in the Glastran when flexed over the 30:1 pulley-to-cable diameter ratio. Stress rupture (sustained load) testing of the cables at 50, 60, and 70 percent of their respective tensile strengths for 30-day periods revealed the Glastran to have superior resistance to creep and equal or longer times to failure than the steel. Both cables failed within 30 days (720 hours) when loaded to 60 and 70 percent of their tensile strength and neither cable failed at 50 percent of break strength. The higher strength-to-weight ratio and creep resistance of the glass-epoxy composite cable indicate that it should receive increased attention for use in tethering balloons. Author

N69-35398# Junta de Energia Nuclear, Madrid (Spain).
THE INDUSTRIAL PLANT AND PROCESSING OF URANIUM OXIDE PELLETS [LA PLANTA DE FABRICACION DE PASTILLAS DE UO SUB 2 BASES EXPERIMENTALES DEL PROCESO ESTABLECIDO]
E. Aparicio Arroyo and J. A. Alonso Folgueras 1969 54 p refs In SPANISH; ENGLISH summary
(JEN-182-DMe/I-17) Avail: CFSTI

An account of the UO_2 research and development carried out at the JEN is first given. This includes a 10 tons/year pellet plant construction. Experimental background of the process is established pointing out both milling advantages and risks, granulation devices, automatic press selection, binder removing and sintering furnaces. Origin, surface area, grain size and O/U rate are considered as raw material reception parameters, although this process shows a wide scope. Research methods, other than powder surface and size, and pellet density controls, are summarized. Finally, further trends and first results toward 3% enriched pellet production are reported. Author (ESRO)

N69-35407*# Centre National de la Recherche Scientifique, Bellevue (France). Laboratoire des Hautes Pressions.

USE OF THE PULSE METHOD TO MEASURE ELASTIC CONSTANTS OF SOLIDS AT HIGH TEMPERATURE: APPLICATION TO SILICON SINGLE CRYSTAL [EMPLOI DE LA METHODE D'IMPULSIONS POUR LA MESURE DES CONSTANTES ELASTIQUES DES SOLIDES A HAUTES TEMPERATURES: APPLICATION AU SILICIUM MONOCRISTALLIN]

Mohamed Ahmed Ezz-El-Arab (Ph.D. Thesis--Paris Univ.) 1969 148 p refs In FRENCH Sponsored by CNRS

Avail: CFSTI

A survey of the different methods used to measure elastic properties in solids has shown the importance of the extension of the pulse method to the high temperature field. The study of ultrasonic propagation allows the evaluation of errors which might occur in the measurement of propagation speed and the experimental difficulty of ultrasonic wave propagation through bounding materials is solved. Results for silicon single crystals are presented. They lead to the conclusion that the elastic properties of this material present a linear decrease in the order of 7% between 25°C and 830°C. ESRO

N69-35430*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AN IN-SITU FACILITY FOR THE DETERMINATION OF THE EFFECTS OF A SPACE ENVIRONMENT ON THE SOLAR ABSORPTANCE OF MATERIALS

Maurice S. Cridlin, Carman A. Nicoletta, and James D. Mann Jun. 1969 6 p refs

(NASA-TM-X-63630; X-713-69-257) Avail: CFSTI CSCL 1/C

Due to the degradation and subsequent recovery of many spacecraft materials based on the measurement of total solar absorptance in laboratory tests, the facility described was designed. Use of a vacuum integrating sphere allowing for an absolute absorptance value eliminates difficulties encountered in optical measurements through a window. Four samples can be mounted in the facility at the same time but irradiated individually. The space environment consists of ultra-high vacuum, low energy protons and electrons, from 1 to 30 Kev, and solar electromagnetic radiation. All radiation doses are measured at the sample position. Sample temperatures are controlled and recorded during the pre-irradiation, irradiation, and optical measurement phases. The above facility should allow for an accurate and dependable means of determining the qualifications of thermal control coatings when exposed to a space environment. Author

N69-35480*# General Electric Co., Philadelphia, Pa. Missile and Space Div.

DEVELOPMENT OF SERIES EMITTANCE THERMAL CONTROL COATINGS Final Report, Sep. 1968 - Jun. 1969

Bernd Linder and Richard N. Griffin Jun. 1969 35 p refs

(Contract NAS1-8603)

(NASA-CR-66820) Avail: CFSTI CSCL 11C

Studies of the behavior of some candidate series emittance coating materials on exposure in vacuum to ultraviolet light and X-ray or low energy proton radiation, were conducted. The term series emittance thermal control coatings denotes a type of flexible second-surface mirror which utilizes a transparent dielectric film over a reflecting substrate where the thickness of the polymeric film can be varied to obtain a series of coatings with varying α_s/ϵ_T ratios. The materials evaluated included Teflon FEP,poly(vinyl butyral), polyethylene (specially prepared), polycarbonate, poly(vinyl fluoride), and an ultrapure silicone. The experimental procedure involved irradiation in vacuum of unmetallized films and periodic measurement in situ, i.e., without removal from the vacuum, of the absorption spectrum. Teflon FEP proved to be the most stable material tested. Poly(vinyl butyral) became more transparent during ultraviolet irradiation, but less transparent during proton irradiation. Polyethylene and poly(vinyl fluoride) were relatively stable to ultraviolet radiation but the latter degraded markedly when exposed to X-radiation. Polycarbonate and ultrapure silicon resin (DC 93-500) degraded rapidly on ultraviolet irradiation. This study established that the use of the spectral transmission measurements in the .2 to .5 micron wavelength region is an extremely sensitive and reliable method of determining stability of polymeric materials. Author

N69-35636# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A METHOD FOR DETERMINING RESIDUAL STRESSES IN COATINGS FROM THE FLEXURE OF A FLAT CATHODE

L. I. Dekhtyar 24 Feb. 1969 8 p refs Transl. into ENGLISH from Elektronnaya Obrabotka Materialov (USSR), no. 2, 1967 p 48-51

(AD-687634; FTD-HT-23-1087-68) Avail: CFSTI CSCL 11/3

A method of calculating residual stresses in coatings built-up on flat cathodes (rods) is presented. The method is based on the classical assumptions of the appearance of residual stresses in a layer during its application and the change in these stresses during the build-up of subsequent (preceding) layers. Author (TAB)

N69-35674# Union Carbide Corp., Oak Ridge, Tenn.

STRUCTURAL STUDIES OF CARBON FOAM WITH A SCANNING ELECTRON MICROSCOPE

C. R. Schmitt, A. L. Coffey, Jr., and J. M. Schreyer 27 Feb. 1969 24 p refs

(Contract W-7405-eng-26)

(Y-1664) Avail: CFSTI

A scanning electron microscope was used for direct examination of structural features and surface topography of low-density carbon foams and thermosetting resins from which these foams were made. Hole and indentation-type structural defects were found that were more prevalent in the weaker foams examined. Author (NSA)

N69-35849*# California Inst. of Tech., Pasadena.

ON THE RELAXATION MODULUS OF THE EQUIVOLUMINAL COMPOSITION OF SOLITHANE 113

H. K. Mueller Jul. 1969 38 p refs

(Grant NGL-05-002-005; F04611-67-C-0057)

(NASA-CR-105392; GALCIT-SM-69-7) Avail: CFSTI CSCL 11J

The purpose of this note is a comparison of the relaxation moduli of Solithane 50/50 (equivoluminal composition of Solithane 113)as determined from relaxation tests on ring specimen and strip specimen. Ring specimen are a particularly convenient type of specimen for testing the mechanical properties of elastomers under uniaxial tension. New data on the relaxation modulus of Solithane 50/50 has been obtained from tests on strip specimen and is compared to the data which has earlier been obtained with ring specimen. The two schemes employed for reducing both sets of experimental data are briefly described. The particular ring geometry used in these experiments is found to be unsuited for relaxation tests at small strains. Author

N69-35871*# Texas Instruments, Inc., Dallas. Components Group.

SOLAR-CELL INTEGRAL COVER-GLASS DEVELOPMENT Final Report, 10 Feb. 1967 - 30 Nov. 1968

30 Nov. 1968 52 p refs
(Contract NAS5-10319)
(NASA-CR-105388; TI-03-68-90) Avail: CFSTI CSCL 11C

The results of a research and development program for applying integral cover-glass coatings to silicon solar cells by radio frequency sputtering are presented. A brief history of the techniques used to deposit insulator films on silicon is given. The theory and experimental details of radio frequency sputtering are discussed. Corning 7940 fused silica was deposited at rates in the 1200 to 2500 Å/min range on both silicon monoxide and cerium dioxide antireflective coated silicon solar cells. Performance of the cells before and after coating was evaluated under tungsten and filtered-xenon light sources. Coatings up to 3-mil thickness successfully passed all environmental testing; thicker coatings tended to delaminate from the cell due to the intrinsic stress of the sputtered layer. Forty samples were fabricated with coatings > 1-mil thickness for evaluation. Author

N69-35873*# Pennsylvania State Univ., University Park. Materials Research Lab.
INVESTIGATION OF THE OPTICAL PROPERTIES OF SILICON SOLAR CELL COMPONENT MATERIALS
K. Vedam 21 Jun. 1969 29 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952385)
(NASA-CR-105280) Avail: CFSTI CSCL 07D

A new method using Kramers-Kronig analysis of normal reflectance data for calculation of the maximum and minimum values of the optical constants of silicon has been developed. It does not require any assumptions for the optical properties of the material outside the wavelength interval for which the data are available, and it is also possible to use without standard values inside this interval. The uncertainty in the optical constants arising from this method is compatible in magnitude with typical experimental errors. Correction for the presence of surface film is also considered. Experimental data on Si are analyzed using this method. Author

N69-35915# Technische Hochschule Aachen (West Germany). Institut für Verfahrenstechnik.
THE MASS DELIVERY PROCESS IN THE FEEDING REGION OF AN EXTRUDER [DER FOERDERVORGANG IN DER EINZUGSZONE EINES EXTRUDERS]
Klaus Schneider (Ph.D. Thesis) [1969] 93 p In GERMAN
Sponsored by Arbeitsgemeinschaft Ind. Forschungsvorhaben
Avail: CFSTI

A mathematical model can be constructed for the flow of plastic granulate assuming block flow in the screw channel, internal pressure in the granulate and a decisive influence of boundary surface friction on mass delivery. Equations were derived for the mass delivery, the pressure distribution and the driving power requirement using experimental values of the friction coefficient. It was found that the surface conditions exert a major influence on the friction coefficient. The pressure measurements provided an anisotropic pressure distribution. General results were derived for the design of extruders. ESRO

N69-35938# Joint Publications Research Service, Washington, D.C.
SUSPENDED SURFACE COATINGS FOR HEAT SHIELDING
Yu. A. Dushin 19 Aug. 1969 9 p Transl. into ENGLISH from Inzh. Fiz. Zh., Akad. Nauk Belorussk SSR (Moscow), v. 8, no. 3, 1965 p 330-334
(JPRS-48641) Avail: CFSTI

A composite coating consisting of refractory surface coatings and low thermal conductivity decomposable lining is considered. Calculations are made of the heat transport for a plane diffusion case when the thermal gradient remains constant over the entire surface and as a function of time. Author

N69-35967# Watervliet Arsenal, N.Y. Benet R and E Labs.
BOND STRENGTH CHARACTERISTICS OF ELECTRODEPOSITED NICKEL ON BORON AND SILICON CARBIDE FILAMENTS (REINFORCED COMPOSITES)
V. Peter Greco and William A. Wallace May 1969 40 p refs
(AD-688863; WVT-6916) Avail: CFSTI CSCL 11/4

The mechanical properties of filament reinforced composites consisting of boron and silicon carbide filaments in an electrodeposited nickel matrix from the sulfamate bath, were investigated. Specific attention was given to filament strength and bond strength characteristics of the filament-matrix interface and the effects from current density, filament surface etching and heat treatment. Author (TAB)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N69-34610*# Texas Univ., Austin. Engineering Mechanics Research Lab.
A PARABOLA TEST FOR SYSTEMS CONTAINING A TIME-VARYING NONLINEARITY
J. A. Walker (Northwestern Univ.) Aug. 1967 7 p refs
(Contract NAS8-18120; Grant NSF GK-249)
(NASA-CR-61522; EMRL-RM-1038) Avail: CFSTI CSCL 12A

The V. M. Popov theorem is employed to show that sufficient conduction for the global asymptotic stability of the equilibrium of a system depends on a real number. Conditions are considered which are interpreted as defining a parabolic forbidden region in the X – Y plane. This parabola condition is applied to feedback systems involving time-varying nonlinearity. F.O.S.

N69-34669*# Texas Univ., Austin. Engineering Mechanics Research Lab.
SOME SUFFICIENT CONDITIONS FOR THE ASYMPTOTIC STABILITY OF LINEAR NONAUTONOMOUS SYSTEMS OF THE SECOND ORDER
J. A. Walker (Northwestern Univ.) Aug. 1967 26 p refs
(Contract NAS8-18120; Grant NSF GK-249)
(NASA-CR-61795; EMRL-RM-1037) Avail: CFSTI CSCL 12A

A quadratic Liapunov function with constant coefficients is used to obtain sufficient conditions for the asymptotic stability of linear systems of the second order. This Liapunov function is then optimized with respect to its coefficients to obtain simplified stability criteria for special classes of such systems. Author

N69-34745# Atomic Energy Establishment Winfrith (England). Technical Assessments and Services Div.
A DESCRIPTION OF THE NUMERICAL METHODS USED IN FIFI 3B
P. T. Wilson Oct. 1968 12 p refs
(AEEW-M-846) Avail: CFSTI/UK

The FIFI 3B is a FORTRAN program used in the analysis of plant dynamics for solving first order linear or nonlinear differential equations. The method of integration is centered on a stable multistep algorithm which uses a predictor-corrector method with relaxation. General numerical integration methods are discussed, with emphasis on their application to the code FIFI.
NSA

N69-34783# Rand Corp., Santa Monica, Calif.
STOCHASTIC REPRESENTATION OF NEARLY GAUSSIAN NONLINEAR PROCESSES
W. C. Meecham (Calif. Univ., Los Angeles) May 1969 28 p refs
(AD-688543; P-4082) Avail: CFSTI CSCL 12/1

The use of polynomial functionals of the white noise process is discussed, for the treatment of nonlinear random processes. It is noted that such treatments are useful for nearly-gaussian processes. Applications of such representations to nonlinear systems and to nonlinear fluid mechanics problems (turbulence) are reviewed.
Author (TAB)

N69-34823# Wisconsin Univ., Madison. Dept. of Statistics.
DESIGNING EXPERIMENTS FOR PRECISE ESTIMATION OF ALL OR SOME OF THE CONSTANTS IN A MECHANISTIC MODEL
William G. Hunter, William J. Hill (Allied Chemical Corp., N.Y.), and Thomas L. Henson Aug. 1968 25 p refs Prepared in cooperation with Allied Chemical Corp.
(Grant NSF-GK-1055)
(PB-183573;TR-172) Avail: CFSTI CSCL 07A

An important experimental problem in chemical engineering is to collect data in order to estimate constants such as rate constants and activation energies which are needed, for example, in equipment and plant design. For a given amount of experimental effort, the engineer wants these constants to be estimated as precisely as possible. In this paper, we discuss statistical design procedures that might be used to accomplish this goal. Available procedures are reviewed for estimating precisely all the constants in a mechanistically based mathematical model. In addition, a new procedure is illustrated for precisely estimating only some of the constants which may be of more interest than the others.
Author (USGRDR)

N69-34877# Michigan State Univ., East Lansing. Statistical Lab.
COMPLEX-VALUED ROOTS OF REAL CHARACTERISTIC FUNCTIONS
Robert G. Staudte, Jr. Aug. 1969 9 p ref
(Grant NSF GP-13484)
(SLP-18; RM-235; RS-2) Avail: Issuing Activity

The converse proposition of the convolution $F * F$ is considered and it is assumed if $F * F$ is symmetric, then F is symmetric. Examples, some discrete and some absolutely continuous, are constructed. Conditions surrounding this proposal are discussed. It is shown that for each $n = 2, 3, \ldots$ there exists an asymmetric distribution function F_n such that F_n^{*m} is symmetric if and only if n divides m. Theorems are stated and proved for the various conditions given.
Author

N69-34880# Atomic Energy Research Establishment, Harwell (England). Theoretical Physics Div.
A FORTRAN SUBROUTINE FOR SOLVING SYSTEMS OF NONLINEAR ALGEBRAIC EQUATIONS
M. J. D. Powell Nov. 1968 54 p refs
(AERE-R-5947) Avail: CFSTI; HMSO: 8s

A FORTRAN subroutine is described and listed for solving a system of nonlinear algebraic equations $f_k(x_1, x_2, \ldots, x_n) = 0$, $k = 1, 2, \ldots, n$. The functions f_k should have continuous first derivatives, but there is no need to calculate these, because the algorithm automatically derives derivative approximations. The method used to obtain the solution to the equations is a compromise between the Newton–Raphson algorithm and method of steepest descents applied to minimize the function $F(x_1, x_2, \ldots, x_n) = \sum_{k=1}^{n} [f_k(x_1, x_2, \ldots, x_n)]^2$, for the aim is to combine a fast rate of convergence with steady progress. Some examples illustrate the technique, and they indicate that the given algorithm compares favorably with other numerical methods for solving nonlinear equations.
Author (NSA)

N69-34907# Iowa State Univ. of Science and Technology, Ames. Ames Lab.
ALGORITHM FOR EIGENVECTORS OF NON-HERMITIAN MATRICES
Albert Maurice Erisman (Ph.D. Thesis) Feb. 1969 78 p refs
(Contract W-7405-ENG-82)
(IS-T-297) Avail: CFSTI

A numerical method for determining eigenvectors of nonhermitian matrices is developed. The method is based on the theorem: For an $n \times n$ complex matrix A and non-zero vectors x and y^*, then $Axy^* - xy^*A = 0$ if and only if x and y^* are column and row eigenvectors of A respectively corresponding to the same eigenvalue. The algorithm is illustrated for real matrices with real eigenvalues for three cases: a well conditioned matrix with well separated roots, a well conditioned matrix with close roots, and a poorly conditioned matrix. In each case, the corresponding calculated eigenvalues are compared with those calculated by the QR algorithm, the best known method for calculating eigenvalues of non-hermitian matrices. An example using a complete matrix is also included. The method developed has the advantage that all work is done with the original matrix; thus there is no accumulation of round-off error either in determining the sequence of approximations or in determining approximations to eigenvectors corresponding to sub-dominant roots.
NSA

N69-34908*# Aztec School of Languages, Inc., Maynard, Mass.
PRINCIPLE OF LEAST WORK DEFORMATION. [UEBER DAS PRINZIP DER KLEINSTEN FORMAENDERUNGSARBEIT]
Theodor Poschl Washington NASA Aug. 1969 5 p Transl. into ENGLISH from Physik. Z. (Ger.), v. 14, May 1913 p 410–412
(Contract NASw-1692)
(NASA-TT-F-12527) Avail: CFSTI CSCL 12A

Proof is provided of Lorenz's formula on least work of deformation by way of analogy with the principles of dynamics of Euler and Hamilton.
Author

N69-34911*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
OPTIMAL POINTWISE FEEDBACK CONTROL OF DISTRIBUTED PARAMETER SYSTEMS
Stuart Gerald Greenburg (Ph.D. Thesis) Jun. 1969 182 p refs
(Grants NGL-22-009-124; NSF GK-2645; MIT DSR Proj. 71139; MIT DSR Proj. 76265)
(NASA-CR-104087; ESL-R-388) Avail: CFSTI CSCL 12A

Systems described by parabolic partial differential equations are formulated as ordinary differential equations in a Sobolev space of a given order. Quadratic cost criteria are then formulated in terms of inner products on this Sobolev space. Existence of an

optimal control is proved both in the case where the system operator is coercive and in the case where the system operator is the infinitesimal generator of a semigroup of operators. The optimal control is given by a linear state feedback law. The feedback operator is shown to be the bounded, positive, self-adjoint solution of a nonlinear operator equation of the Riccati type. This operator can also be represented by an integral operator whose kernel satisfies a Riccati-like integro-differential equation. The optimal pointwise control is given by a simplified linear control law which depends on the control point location. The general results are specialized to obtain the modal approximation to the pointwise control problem and to demonstrate the optimality of output feedback for a particular class of output transformations. Author

N69-34925# Catholic Univ. of America, Washington, D.C.
LARGE DEFLECTION RESPONSE OF SPHERICAL CAPS
Nicholas Perrone and Robert Kao Jun. 1969 28 p refs
(Grant NSF GK-2802)
(Rept-12) Avail: Issuing Activity

The Marguerre equations governing the finite deflections of spherical caps are adopted in the form of three equilibrium equations with u, v, and w, the usual displacement quantities which are also the dependent variables in the differential equations. The equations are solved for a number of different load situations using a finite difference nonlinear relaxation technique. A number of axisymmetric problems are solved including the following: (1) uniformly loaded cap, (2) cosine loaded cap, and (3) uniformly loaded cap with clamped apex region. In addition, a program which solves the general asymmetrically loaded cap is set up and an example solution of a semicircularly, uniformly loaded cap is presented. Where possible, comparisons with existing solutions are made and deviations are relatively slight. Author

N69-34927# General Electric Co., Schenectady, N.Y. Knolls Atomic Power Lab.
TOLERANCE LIMITS FOR VARIABLES SUBJECT TO A NORMALLY DISTRIBUTED ERROR OF MEASUREMENT
W. G. Howe 7 Jan. 1969 22 p refs
(Contract W-31-109-ENG-52)
(PB-183103; KAPL-M-6971) Avail: CFSTI CSCL 12A

Statistical tolerance limits are sample statistics so calculated that the probability is beta that these limits include at least gamma % of the population. Such limits have long been in use both for normal populations and for arbitrary (non-parametric) populations. However, when the population values of interest are masked by a normally distributed error of measurement, statistical tolerance limits were not available. As a consequence, quality control and quality evaluation tolerance procedures either ignored measurement error or were abandoned. This memorandum gives approximate statistical tolerance limits for both the normal and non-parametric cases when measurement error is present. Author (USGRDR)

N69-34959*# Georgia Univ., Athens. Dept. of Statistics.
AN APPLICATION OF STATISTICS IN MIXTURE OF EXPONENTIAL DISTRIBUTIONS
H. I. Patel May 1969 14 p refs
(Contract NAS8-11175)
(NASA-CR-61292; Rept-61292) Avail: CFSTI CSCL 12A

This paper is concerned with a distribution of an order statistic when a sample of n is composed of n_1 observations. In particular the expected value of the nth order statistic has been obtained when the sample is composed of two types of components and when it is composed of three types of components. The distribution of the nth order statistic in the most general situation has been obtained. A small application to cost analysis of ore samples is mentioned. Author

N69-34965 European Organization for Nuclear Research, Geneva (Switzerland). Theoretical Studies Div.
INTRODUCTION TO ALGEBRAIC TECHNIQUES
M. Guenin, A. Wehrl, and W. Thirring 3 Jun. 1969 129 p refs
Presented at the Theoret. Seminar Ser. at CERN, Geneva, 1968–1969
(CERN-69-14) Avail: Issuing Activity

The use of algebraic and functional-analytical methods to characterize modern theoretical physics is discussed. The general properties of associative algebras, von Neumann algebras, and C^* algebras are discussed in their application to the quantum theory. The determination of the factor type of some algebras constructed as infinite tensor products are explored. The acquired results are applied to the theory of the BCS and related models. E.H.W.

N69-34972*# Brown Univ., Providence, R.I. Center for Dynamical Systems.
ON THE STABILITY OF RANDOMLY SAMPLED SYSTEMS
H. J. Kushner and L. Tobias (NASA Electron. Res. Center) [1968] 28 p refs
(Grants NGR-40-002-015; AF-AFOSR-693-67; NSF GK-2788)
(NASA-CR-104135) Avail: CFSTI CSCL 12A

Randomly sampled linear systems with linear or nonlinear feedback loops are studied by a stochastic Liapunov function method. Improved criteria for stability are given, when the sequence of holding times are independent. The method is relatively straightforward to apply (especially in comparison with the direct methods), and allows the study with nonlinear feedback, or nonstationary holding times. A randomly sampled Lurè problem is studied. Numerical results, describing some interesting phenomena (such as jitter stabilized systems), are presented. Author

N69-34981# Joint Publications Research Service, Washington, D.C.
THE THEORY OF BRANCHING SYSTEMS
B. P. Petrov 8 Aug. 1969 6 p ref Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 188, no. 4, 1969 p 783–786
(JPRS-48584) Avail: CFSTI

Within a system (1) of ordinary differential equations, where the right-hand side of the system belongs to a locally compact set F(denoted a space), and an integral of the system has a unique solution at a given point, the topological product will be called the space of the state. Probability measures of Borel sets are defined in spaces and considered as basic probability spaces containing random processes. A characteristic of the random process and the solutions of spaces state is the branching process of the solution of system (1). Branching systems are defined in four states depending on the relation to the sets, half-intervals, and the probability measures. Conditions for the stability of branching systems are also defined and offered as a means of estimation of the probability of the stable operation of the system. M.H.E.

N69-34993# Michigan State Univ., East Lansing. Statistical Lab.
RANDOM RANK STATISTICS AND CONFIDENCE INTERVALS
Hira L. Koul Aug. 1969 20 p refs
(Grant NSF GP-13484)
(SLP-17; RM-234; HLK-4) Avail: Issuing Activity

A bounded length confidence interval of preassigned coverage probability for a regression parameter θ, using rank statistics is given. Such an interval based on signed ranks and showing that as length of interval tends to zero, the coverage probability meets

preassigned limit is presented. That some weighted random empirical processes are relatively compact is shown. These results are used to show that the Wilcoxon type rank statistics based on random number of observations is asymptotically linear in regression parameter. Asymptotic normality of random sign rank statistic under the null hypotheses is established. Author

N69-34997# Michigan State Univ., East Lansing. Statistical Lab.
THE ADMISSIBILITY OF CERTAIN INVARIANT STATISTICAL TESTS INVOLVING A p-DIMENSIONAL LOCATION PARAMETER
Martin Fox Jul. 1969 9 p refs
(Grant NSF GP-13484)
(SLP-14; RM-231; MF-10) Avail: Issuing Activity

That certain invariant statistical tests are admissable in the proof of p-dimensional parameters such as Euclidean spaces is demonstrated in a theorem which asserts that statistical measures are preferable to more commonly used estimations. Following the proof of the theorem, the hypotheses that the variance has a given value in a general linear model is provided in an application. M.H.E.

N69-34998# Michigan State Univ., East Lansing. Statistical Lab.
ON WEAK CONVERGENCE IN STOCHASTIC PROCESSES
Vaclav Fabian Jul. 1969 7 p refs
(Grant NSF GP-13484)
(SLP-15; RM-232; VF-8) Avail: Issuing Activity

Presented are theorems and proofs for weak convergence. The objective is to give an alternative and shorter way for proving this convergence of measures on product space. Weak convergence is proven directly from the assumption concerning equicontinuity. E.H.W.

N69-34999# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
AN INVESTIGATION OF BIVARIATE NORMAL LOGNORMAL DISTRIBUTIONS
Alfred E. Crofts, Jr. (Ph.D. Thesis) 6 May 1969 110 p refs
(Contract N00014-68-A-0515)
(AD-688407; THEMIS-SMU-TR-32) Avail: CFSTI CSCL 12/1

Both the normal and lognormal distributions are used to describe a great variety of phenomena. This paper is concerned with the bivariate distribution of (X, Y) that arises when one variate, say X, is distributed normally, the conditional distribution of the other, for a given X is lognormal, and the form of the regression $E(Y/X = x)$ is known. Two forms of the regression curve are investigated; it is hoped that this method of approach will prove useful for other regression functions. Author (TAB)

N69-35001# Wisconsin Univ., Madison. Dept. of Statistics.
SOME TESTS OF INDEPENDENCE FOR STATIONARY MULTIVARIATE TIME SERIES
Grace Wahba Dec. 1968 58 p refs
(Grant NSF GP-4265)
(TR-187; PB-183580) Avail: CFSTI CSCL 12A

Null hypotheses are derived for a P-dimensional zero-mean Gaussian time series possessing a spectral density matrix that satisfies some mild regularity conditions. Approximate likelihood ratio tests are derived and the test statistics are found to be functions of the time series matrix. G.G.

N69-35005# West Virginia Univ., Morgantown. Engineering Experiment Station.
QUALITY CONTROL MODELS FOR ATTRIBUTES SAMPLING SYSTEMS
J. W. Schmidt and Jack Byrd Oct. 1968 60 p refs
(PB-183230; Rept-2) Avail: CFSTI CSCL 13H

The purpose of the study was to investigate methods of developing economical single sampling plans to attributes. To accomplish this, mathematical models were developed for several cases of incoming, in plant, and outgoing attributes inspection. Optimization of these models with respect to the decision variables in the model allows the analyst to determine the most economical quality control system. Author (USGRDR)

N69-35009*# Brown Univ., Providence, R.I. Center for Dynamical Systems.
STABILITY CRITERIA FOR A CANTILEVER SUBJECTED TO A TIME-DEPENDENT FOLLOWER FORCE
R. H. Plaut [1968] 10 p refs
(Grants NGR-40-002-015; AF-AFOSR-693-67; Contract DA-31-124-ARO(D)-270)
(NASA-CR-104139) Avail: CFSTI CSCL 12A

The stability of a nonconservative nonautonomous system, a cantilevered column subjected at its free end to a compressive follower force which varies with time is investigated. Viscous damping is assumed to be present. With the use of a Liapunov type of approach, conditions are obtained which guarantee asymptotic stability or almost sure asymptotic stability of the column. Author

N69-35014# Michigan State Univ., East Lansing. Statistical Lab.
ON AN EXTENDED COMPOUND DECISION PROBLEM
Dennis C. Gilliland and James F. Hannan Jun. 1968 11 p refs
(Grant NSF GP-7362)
(SLP-11; RM-211; DCG-6; JFH-6) Avail: Issuing Activity

Developed are some theorems for an extended compound decision problem which has as the component a general statistical decision problem. Results generalize and strengthen some of the results previously reported by other authors. However, more notation is contained here by defining $R_A(.)$ to the Baynes envelope. Author

N69-35065# International Centre for Theoretical Physics, Trieste (Italy).
CURRENT ALGEBRA, FIELD ALGEBRA K SUB L3 FORM FACTORS
G. Denardo (Trieste Univ.), and G. J. Komen May 1969 28 p refs Submitted for publication
(IC/69/30) Avail: CFSTI

Current algebra is used to obtain relations among the K_{l3} form factors by means of saturating the appropriate charge-current commutator. The frame dependence of the saturation is discussed. Since the current algebra relations do not determine the form factors themselves it is shown how either the assumption of once subtracted dispersion relations or the use of field algebra commutators gives additional information which enables one to write an expression for the form factors. Finally, a rough numerical estimate of the results is given. Author (ESRO)

N69-35090*# Georgia Univ., Athens. Inst. of Statistics.
ON THE PROBABILITY OF EXTENDING AN OBSERVATION Final Report, Nov. 1968 – May 1969
A. Clifford Cohen Huntsville, Ala. NASA. Marshall Space Flight Center Apr. 1969 72 p refs
(Contract NAS8-11175)
(NASA-CR-61284; TR-35) Avail: CFSTI CSCL 12A

Procedures and related computational aids are developed for simplifying the calculation of conditional probabilities for both continuous and discrete ramdom variables involved in decisions concerning missile launch schedules. Tables of conditional probabilities in the normal and in the Pearson type 3 distribution are included. Author

N69-35099*# Georgia Univ., Athens. Dept. of Statistics.
PROBABILITY MODELS FOR THE VARIATION IN THE NUMBER OF THUNDERSTORM HITS PER DAY
William O. Williford and Michael C. Carter Huntsville, Ala. NASA. Marshall Space Flight Center Jul. 1969 23 p refs
(Contract NAS8-11175)
(NASA-CR-61289; Rept-37) Avail: CFSTI

From among three modified discrete probability distributions investigated, a modified negative binomial distribution is recommended as the 'best' model to represent the variation in the number of thunderstorms per day which move across a launch site at Cape Kennedy, Florida. Author

N69-35147# European Space Research Inst., Frascati (Italy).
THE SHOOTING METHOD FOR SINGULAR DIFFERENTIAL OPERATORS
M. Soop 1969 25 p refs Submitted for publication
Avail: CFSTI

A method is given for numerically computing the lowest eigenvalue of an ordinary Hermitian differential operator on one or more functions on an infinite interval. The eigenvalue equation can be transformed into a non-linear matrix differential equation corresponding to the Riccati equation for a second order operator. Some properties of this equation are given that make it possible to seek out the eigenvalue in a systematic way. Author (ESRO)

N69-35183# Fondazione Ugo Bordoni, Rome (Italy).
NORNAND-MAITRA CASCADES
Giuseppe Fantauzzi 11 Aug. 1967 21 p refs
Avail: CFSTI

Efficient algorithms are available to test for the redundancy or irredundancy of Maitra cascades. More particular structures for Maitra cascades are considered in which each cell can perform only the function(s) NOR or/and NAND. Thus there are three kinds of cascades NOR, NAND and NORNAND, the two first ones being particular cases of the NORNAND cascade. An algorithm is given for testing if a function can be synthesized by one of the above cascades. This algorithm always gives one of the best (i.e. the shortest) cascades realizing the given function. ESRO

N69-35186# Michigan State Univ., East Lansing. Statistical Lab.
APPLICATION OF DYNAMIC PROGRAMMING METHODS TO A PROBLEM OF IDENTIFICATION BY SEQUENTIAL EXPERIMENTATION
Robert Carl Juola Aug. 1968 61 p refs
(Grant NSF GP-7382)
(SLP-12; RM-213; RCJ-1) Avail: Issuing Activity

Statistical problems of the identification type are analyzed in which the data are assumed to have been generated by one of a family of possible generating mechanisms. It is desired to know *with certainty* which of the mechanisms is the true generating mechanism for the observed data. The dynamic programming approach is used for amassing of the data necessary to make the *certain* identification sequentially, for choosing one of a number of possible experiments to obtain the next datum, and for finding an optimal decision strategy for obtaining the next datum. The approach is demonstrated on a formal problem with infinitely many possible generating mechanisms for finding the true mechanism (i.e., a special case of a multiple decision problem in which the probability of making an error is required to be zero). K.W.

N69-35191# Washington Univ., Seattle.
GENERALIZED FACTOR ANALYSIS. PART 1: RATIONALE
Paul Horst Apr. 1969 91 p refs
(Contract Nonr-477(33); PHS-G-2-R01-MH00743-14)
(AD-686802) Avail: CFSTI CSCL 12/1

In the report the rationale for a generalized approach to scale free factor analysis is developed. Special cases of a scaling function parameter and a loss function parameter yield the canonical, minres, alpha and principal components models of factor analysis. A new method of oblique transformation to simple structure loadings is developed. Rationales for the computation of factor scores are generalized and a new rationale is presented. TAB

N69-35193# Harvard Univ., Cambridge, Mass. Lab. for Computer Graphics and Spatial Analysis.
GEOGRAPHY AND THE PROPERTIES OF SURFACES. A MINIMUM PATH PROBLEM RECONSIDERED
C. Ernesto S. Lindgren 21 Feb. 1969 13 p refs *Its* Paper No. 28
(Contract N00014-67-A-0298)
(AD-688456; ONR-TR-28) Avail: CFSTI CSCL 13/2

The methodology for generalization of spatial distributions suggests a new solution for the determination of minimum paths between any two points covered by the distribution. Previous solutions required the collection of information about each point of from at least two points. The paper discusses a solution when the information related to any one point suffices for the determination of all paths. Author (TAB)

N69-35194# Harvard Univ., Cambridge, Mass. Lab. for Computer Graphics and Spatial Analysis.
GEOGRAPHY AND THE PROPERTIES OF SURFACES. NOTES ON THE METHODOLOGY FOR GENERATION OF THE REPRESENTATIVE OF A SET Interim Report
C. Ernesto S. Lindgren 14 Feb. 1969 41 p refs *Its* Paper No. 27
(Contract N00014-67-A-0298)
(AD-688455; ONR-TR-27) Avail: CFSTI CSCL 12/1

The advent of advanced methodology concerning graphical constructions in n-dimensional space provides new means of generation of surfaces. This methodology is summarized and complemented with recently established graphical relationships, suggesting new approaches in the study of spatial distributions. Author (TAB)

N69-35201# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
A PARAMETRIC FORM FOR THETA IN A COMBINED STATISTIC OF THE FORM p SUB 1 p SUB 2 SUP THETA
Elinor Sandborn Pape (M.S. Thesis) 1 May 1969 43 p refs
(Contract N00014-68-A-0515; Proj. THEMIS
(AD-688406; THEMIS-SMU-TR-31) Avail: CFSTI CSCL 12/1

The general problem under consideration is that of combining test statistics, S sub 1 and S sub 2, from two independent tests into one statistic of the form (P sub 1)((P sub 2) superscript theta) for the purpose of testing a particular null hypothesis, H sub 0. TAB

N69-35206# Wisconsin Univ., Madison. Dept. of Statistics.
LINEAR FUNCTIONS OF ORDER STATISTICS
Stephen Mack Stigler Oct. 1968 35 p refs
(Grants NSF GP-2593; NSF GP-5059)
(TR-178; PB-183576) Avail: CFSTI CSCL 12A

The purpose of the paper is to investigate the asymptotic normality of linear combinations of order statistics. USGRDR

N69-35207# Fondazione Ugo Bordoni, Rome (Italy).
A SEMIGROUP THEORY FOR THE MAITRA CASCADE
Giuseppe Fantauzzi 10 Nov. 1967 29 p refs
Avail: CFSTI

In cellular logic, many problems seem to be very difficult to solve without using more advanced mathematical concepts like semigroup theory and partition pair algebra. Recently, for this reason, some attempts have been made to apply discrete mathematics to the study of cellular arrays. In this paper it is shown that all the essential results about a particular, but very important cellular array can be obtained by using some simple results of semigroup theory. This cellular array is called the Maitra cascade. The theory of the Maitra cascade is explained in this paper in a unified fashion. For the main results new proofs are given, which are generally simpler than those obtained by applying the classical switching theory. The results obtained in this paper seem to be useful for the theory of the Maitra cascade and for its possible generalization to more complex cellular arrays. Author (ESRO)

N69-35225*# Texas Univ., Austin. Engineering Mechanics Research Lab.
STABILITY OF A CLASS OF COUPLED SYSTEMS
W. L. Garrard and J. A. Walker (Northwestern Univ.) Aug. 1967 6 p refs
(Contract NAS8-18120)
(NASA-CR-61850; EMRL-RM-1038) Avail: CFSTI CSCL 12A

A system is considered whose control stability can normally be determined by solving a set of coupled second-order differential equations. The corresponding theorem is proven in this paper. The stability results thus obtained are applicable in problems of sub-orbital attitude control for artificial satellites using motor-driven inertia wheels for control torque. K.W.

N69-35253# Wisconsin Univ., Madison. Dept. of Statistics.
COMBINATIONS OF UNBIASED ESTIMATORS OF THE MEAN WHICH CONSIDER INEQUALITY OF UNKNOWN VARIANCES
J. S. Mehta and John Gurland Oct. 1968 25 p refs Supported by NSF
(TR-175; PB-183575) Avail: CFSTI CSCL 12A

The problem considered in the paper is how to combine estimators of the common mean from two samples corresponding to normal populations with different unknown variances. Attention is confined to the case where it is known that the variance of one specific population exceeds that of the other. Three classes of unbiased estimators are presented, one of which is based on a preliminary test of significance regarding the ratio of the population variances. The gain achieved by utilizing the knowledge that the ratio of variances exceeds one is investigated by comparing the efficiencies of these estimators with an estimator presented by Graybill and Deal in which no restriction on the ratio of variances is present. Author (USGRDR)

N69-35254# Wisconsin Univ., Madison. Dept. of Statistics.
SOME PROPERTIES AND AN APPLICATION OF A STATISTIC ARISING IN TESTING CORRELATION
J. S. Mehta and John Gurland Jan. 1969 21 p refs
(Grant NSF GP-7705)
(TR-182; PB-183578) Avail: CFSTI CSCL 12A

In testing a hypothesis concerning the correlation coefficient in a bivariate normal distribution where all the parameters are unknown, the Pearson product moment statistic is appropriate. It may happen, however, that there are relations among the parameters in the distribution, in which case the Pearson statistic would not utilize this information. In particular if the variance of the two marginal distributions are equal, it is possible to test the correlation coefficient by means of simpler statistic which makes use of this information. The paper indicates how this statistic arises and present some properties of its distribution. Author (USGRDR)

N69-35270# Wisconsin Univ., Madison. Dept. of Statistics.
TESTING EQUALITY OF MEANS IN THE PRESENCE OF CORRELATION
J. S. Mehta and John Gurland Oct. 1968 26 p refs Supported by NSF
(TR-174; PB-183574) Avail: CFSTI CSCL 12A

The purpose of the paper is to develop a procedure for testing equality of means in the presence of possible correlation or lack of it. A further problem which will also be considered is how to test equality of means when some observations from one of the populations are missing. USGRDR

N69-35271*# Brown Univ., Providence, R.I. Center for Dynamical Systems.
AN INVARIANCE PRINCIPLE FOR DYNAMICAL SYSTEMS IN HILBERT SPACES
M. Slemrod and E. F. Infante [1969] 8 p refs
(Grant NGR-40-002-015; Contract DA-31-124-ARO(D)-270; Grant NSF GP-9024)
(NASA-CR-103954) Avail: CFSTI CSCL 12A

For the analysis of certain mixed initial boundary value problems, a new approach is offered using an invariance principle for weak dynamical systems in Hilbert spaces. The conditions of mapping a weak dynamical system are defined on a Banach space, and an invariant set of the weak dynamical system is defined in terms of its function. With this structure established, an invariance principle is stated in theorem 1. The assumption that the system under consideration is both a weak dynamical system and a dynamical system is proven in theorem 2. The resulting wave equation is applied to (1) tunnel diode systems, and (2) asymptotic behavior of the equations of linear thermoelasticity. Consequently theorem 1 provides the necessary conditions for weak dynamical systems to achieve stability. M.H.E.

N69-35281# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.

AN OPTIMUM DISCRETE SPACE SEQUENTIAL SEARCH PROCEDURE WHICH CONSIDERS FALSE ALARM AND FALSE DISMISSAL INSTRUMENT ERRORS

Mark W. Smith (Ph.D. Thesis) 16 May 1969 96 p refs
(Contract N00014-68-A-0515; Proj. THEMIS)
(AD-688410; THEMIS-SMU-TR-35) Avail: CFSTI CSCL 12/2

An optimum sequential search policy is developed for locating an object in a discrete search space assuming a search instrument having both false alarm and false dismissal errors. The search policy obtained specifies that the experimenter always takes his next observation at the potential location which has the largest a posteriori probability of being the true location as computed from the prior probability distribution and previous experimental evidence via Bayes Rule. The results were derived under the following assumptions. A single object is assumed to be located in 1 of N locations and to remain stationary during the search process. The experimenter is presumed to have an initial discrete a priori probability function describing the location of the object. Also available is a single search instrument which the experimenter can employ to examine each of the potential locations. Only one location can be observed at any one time, however. The instrument is assumed to perform a simple, fixed sample size, hypothesis test having known conditional error probabilities of both Type I and Type II. The preliminary decision made by the instrument is thus a noisy decision which is only statistically related to the presence or absence of the object at the location in question. A communication system search example is also considered. Author (TAB)

N69-35337# Iowa State Univ. of Science and Technology, Ames.

NEW APPROACH TO REPRESENTATIONS OF THE LORENTZ GROUP

William Henry Greiman (Ph.D. Thesis) Feb. 1969 61 p refs
(Contract W-7405-eng-82)
(IS-T-276) Avail: CFSTI

Representations of the Lorentz group in bases labeled by the conformal group and the rotation group are considered. The transformation coefficients connecting the rotation group and conformal group bases are derived. These coefficients together with an Iwasawa decomposition of the Lorentz group, which implies that any Lorentz transformation may be decomposed into the product of a conformal group element and a rotation, are used to obtain representations of the Lorentz group in a conformal group basis. Several expressions for matrix elements in a rotation group basis are derived in the more conventional Cartan decomposition of the Lorentz group. These results are applied to the problem of expanding the wave function for a particle with spin in terms of representations of the homogeneous Lorentz group. Sets of functions analogous to spherical harmonics are derived in both the conformal group and rotation group bases. Author (NSA)

N69-35352# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.

ESTIMATING THE PARAMETER k OF THE RAYLEIGH DISTRIBUTION FROM CENSORED SAMPLES

Dwight B. Brock (M.S. Thesis) 16 Apr. 1969 28 p refs
(Contract N00014-68-A-0515; Proj. THEMIS)
(AD-688404; THEMIS-SMU-TR-29) Avail: CFSTI CSCL 12/1

Let g(x) be the ratio of the ordinate and the probability integral for the Rayleigh distribution. That is, g(x) = f(x)/F(x), where f(x) = (2x/k)exp(-x squared/k), x > 0, k > 0, and F(x) = the integral from 0 to x of f(t)dt. Tikus local approximation g(x) is approximately equal to alpha + beta x/the square root of k is used to simplify the maximum likelihood equation for estimating k from a doubly censored sample from this population. The solution to the simplified maximum likelihood equation is the estimator for k, which is called k sub c. It is much easier to compute than the maximum likelihood estimator, since no iterative procedure is required. After the solution for k sub c is given, equations are developed for its bias and variance. Numerical comparisons are made among k sub c and other estimators for k. Author (TAB)

N69-35353# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.

ON TESTING SOME LINEAR RELATIONS AMONG VARIANCES

James M. Davenport 12 Apr. 1969 39 p refs
(Contract N00014-68-A-0515; Proj. THEMIS)
(AD-688403; THEMIS-SMU-TR-28) Avail: CFSTI CSCL 12/1

In statistical methods, it is often desirable to test that the following relation holds among the variances theta sub i: The sum from m=1 to m=k of (C sub m) (theta sub m) = the sum from j=k+1 to j=p of (C sub j)(theta sub j). An assumption made in this paper is that there exists independent mean square estimates v sub i of the variances theta sub i such that (n sub i)(v sub i)/theta sub i follows the chi-square distribution for each i = 1, 2, ... p. An approximate test of the above relation is Satterthwaites approximate F-test. A solution, when testing the relation theta sub 3 = theta sub 1 + theta sub 2, is developed for finding the true probability of being in the rejection region, when the Satterthwaite approximate F-test is used, and these probabilities are presented for several values of the parameters involved. A comparison of the results obtained is made with the work done by W. G. Cochran in this area. In addition, methods are developed for finding the true probabilities of being in the rejection region, when using Satterthwaites approximate F-test for testing the relations theta sub 1 + theta sub 2 = theta sub 3 + theta sub 4 and theta sub 1 = theta sub 2 + theta sub 3 - theta sub 4. However, in these cases none of the probabilities are presented. Author (TAB)

N69-35354# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.

POISSON COUNTS OF A MARKOVIAN RENEWAL PROCESS

A. M. Kshirsagar 18 Apr. 1969 13 p refs
(Contract N00014-68-A-0515; Proj. THEMIS)
(AD-688405; THEMIS-SMU-TR-30) Avail: CFSTI CSCL 12/1

If a Poisson process and a renewal process commence simultaneously, the number of renewals in the interval between the (r - 1)th and rth occurrences of the Poisson events is called the rth Poisson count of the renewal process. This notion is extended in this paper to a Markovian renewal process. In a Markovian renewal process, the system makes transitions to different states according to a Markovian transition probability matrix but the time taken to make these transitions is a random variable. The number of visits to these different states in the interval between the (r - 1)th and the rth Poisson events are the Poisson counts of the Markovian renewal process. Their joint probability distribution is derived in this paper. Further, distribution of Poisson counts of an associated cumulative process is also derived both for an ordinary renewal process as well as a Markovian renewal process. Author (TAB)

N69-35403* California Univ., Los Angeles.
A BOUND FOR THE SPECTRAL RADIUS OF A MATRIX
James M. Sloss [1968] 10 p ref
(Grant NGR-05-010-008)
(NASA-CR-104104) Avail: CFSTI CSCL 12A

A bound is derived for the eigenvalues of a complex matrix $A = (a_{ij})$ in terms of a_{ij}. The estimate is derived by constructing an integral equation with degenerate kernel for which each finite eigenvalue is the reciprocal of a non-zero eigenvalue of A. The corresponding theorem and lemma are proven, and the estimates are compared with the bounds of a matrix cited in the literature. K.W.

N69-35404# Wisconsin Univ., Madison. Dept. of Statistics.
THE DETERMINATION OF AVERAGE RUN LENGTH AND A CONTOUR NOMOGRAM FOR THE DESIGN OF CUMULATIVE SUM CONTROL CHARTS
A. I. Goel (Syracuse Univ., N.Y.) and S. M. Wu Oct. 1968 32 p refs
(PB-183577; TR-179) Avail: CFSTI CSCL 12A

The average run length of a Cusum chart is calculated by the method of Systems of Linear Algebraic Equations. The accuracy of this method is evaluated and the results are compared with those obtained by other approximate methods. The construction and use of a new nomogram based on the contours of average run lengths is discussed. Numerical examples are given to illustrate the flexibility and convenience provided by this nomogram in the design of Cusum charts. Author (USGRDR)

N69-35419# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
SEMISIMPLE LIE GROUPS AND ALGEBRAS AND THEIR REPRESENTATIONS [POLUPROSTYE GRUPPY I ALGEBRY LI I IKH PREDSTAVLENIYA]
A. U. Klimyk 1968 215 p refs In RUSSIAN; ENGLISH summary
(ITF-68-15) Avail: AEC Depository Libraries

The exclusive role which was assigned to group theory is explained by the circumstance that symmetrical physical objects always correspond to a certain group of operations preserving this symmetry. An especially important role in physics is given to semisimple groups and their representations (finite- and infinite-dimensional). The main concepts of groups are discussed. The irreducible representations of semisimple Lie algebras are considered. The properties of such representations are very similar to the properties of finite-dimensional representations. Introduction of the character of higher representations permits one to resolve the problems of decomposition of the direct product of such representations with irreducible representations, and the decompositions of the contraction of such a representation of semisimple subalgebras, the representation of which is considered. Such questions of decomposition are discussed. NSA

N69-35434*# Southern Methodist Univ., Dallas, Tex.
GENERALIZED ASYMPTOTES FOR EXTREME VALUE DISTRIBUTIONS
Charles Lloyd Anderson (Ph.D. Thesis) 19 Apr. 1969 29 p refs
(Grant NGR-44-007-028)
(NASA-CR-105273) Avail: CFSTI CSCL 12A

Some new asymptotic forms for extreme value distributions are given, the most important being $\exp(-\exp(-a^2(X-b)^2 \operatorname{sgn}(X-b) + c^2))$ where x is the identity function on the extended real line and a, b, and c are real parameters. The family of distributions of this form is called the quadratic type of dne. It is shown that the sequence of extreme value distributions from a normal distribution is asymptotically attracted to the quadratic type of dne. It is also shown that the distribution of the largest value in a sample from a normal population can be approximated rather closely by a distribution in the quadratic type of dne even when the sample size is fairly small. Various senses of asymptotic attraction and asymptotic equivalence for sequences of distribution functions are discussed and compared re normal and Poisson populations. Author

N69-35463*# Colorado Univ., Boulder. Dept. of Electrical Engineering.
SENSITIVITY REDUCTION THROUGH REOPTIMIZATION
Frederick James Taylor 30 Jun. 1969 149 p refs
(Grant NGR-06-003-083)
(NASA-CR-96009) Avail: CFSTI CSCL 12A

The ability to maintain an optimal solution independent of parameter variations is philosophically appealing. Unfortunately, whenever the internal system parameters change in value, the system usually no longer operates in an optimal fashion. Therefore, the purpose of this research is to devise a scheme which will continually adjust its control strategy in such a manner that the control remains optimum for a set of parameter variations. To accomplish this, the maximum principle is applied to a truncated Taylor series representation of the Hamiltonian of the system with parameter variations. An adaptive control strategy is thereby derived. However, the adaptive structure requires plant identification, so special attention is given to this problem. Author

N69-35491# Commissariat à l'Energie Atomique, Paris (France).
PRINCIPLE OF THE DETERMINATION OF NEUTRON MULTIPLICATION COEFFICIENTS BY THE MONTE-CARLO METHOD. APPLICATION AND DESCRIPTION OF A CODE FOR IBM 360-75 [PRINCIPE DE LA DETERMINATION DES COEFFICIENTS DE MULTIPLICATION NEUTRONIQUE PAR LA METHODE DE MONTE CARLO. APPLICATION. DESCRIPTION D'UN CODE POUR IBM 360-75]
Jean Moreau and Bernard Parisot May 1969 37 p refs In FRENCH; ENGLISH summary
(CEA-R-3798) Avail: CFSTI

The determination of neutron multiplication coefficients by the Monte Carlo method can be carried out in different ways and these are described and compared. A rapid code is deduced for particularly complex geometries which makes use of multigroup isotropic cross-sections. The use of this code is illustrated by some examples. Author (ESRO)

N69-35498# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
EQUATIONS OF MOTION IN ODO-DIMENSIONAL SPACES AND T, C-INVARIANCE
V. I. Fushchich 1969 13 p refs In RUSSIAN; ENGLISH summary
(ITF-69-17) Avail: AEC Depository Libraries

The properties of the equation of Dirac type in three-dimensional and five-dimensional Minkowski space-time with respect to time reflection (in sense of Pauli and Wigner) as well as to the operation of charge conjugation are investigated. P-, T-, C-invariance of the Dirac equation for the cases of four components (in three-dimensional space) and eight components (in five dimensional space) is established. Within the framework of the Poincaré group a relativistic equation is suggested which describes the movement of a particle with nonfixed (indefinite) mass in an external electromagnetic field. Author (NSA)

N69-35522*# Techtran Corp., Glen Burnie, Md.
CONDITIONS OF CONTROLLABILITY IN ONE PROBLEM OF PURSUIT [OB USLOVIYAKH UPRAVLYAEMOSTI V ODNOY ZADACHE SBLIZHENIYA]
N. A. Babakov and D. P. Kim Washington NASA Aug. 1969 11 p refs Transl. into ENGLISH from IFAC Tech. Session no. 49 (Warsaw), 16-24 June 1969 p 3-15
(Contract NAS2-1695)
(NASA-TT-F-12485) Avail: CFSTI CSCL 12A

The problem of controllability in three-dimensional pursuit of one point by another is analyzed. The problem is formulated as that of determining the range of controllability in space of the initial conditions of pursuit. The general case of three-dimensional pursuit is analyzed and the necessary and sufficient condition for this case is formulated. The solution incorporates the principle of L. S. Pontryagin's maximum. Author

N69-35553*# Techtran Corp., Glen Burnie, Md.
THEORY OF TRANSVERSE OSCILLATIONS OF A QUADRATIC PLATE WITH FREE BOUNDARIES [THEORIE DER TRANSVERSALSCHWINGUNGEN EINER QUADRATISCHEN PLATTE MIT FREIEN RANDERN]
Walter Ritz Washington NASA Aug. 1969 48 p refs Transl. into ENGLISH from Ann. Physik (Leipzig), no. 38, 1909 p 737-787
(Contract NASw-1695)
(NASA-TT-F-12332) Avail: CFSTI CSCL 12A

A new method of integration is developed which can be used for rectangular plates, free or with stressed or supported edges. The method is intended for use with most plates by the use of polynomials. The essence of the new method consists in the fact that it is approached not from the differential equations and boundary conditions of the problem but direct from the principle of the least effect, out of which all equations and conditions can be derived, even by variations. Author

N69-35556# Oxford Univ. (England). Dept. of Engineering Science.
A WIENER-HOPF EQUATION ARISING IN ELASTIC CONTACT PROBLEMS
D. A. Spence 1967 18 p refs
(REPT-1-032-67) Avail: CFSTI

The integral equation derived in the preceding paper (Spence 1967, referred to as I) is solved by the Wiener-Hopf technique. In order to apply the technique it is necessary to replace the kernel k(t), which is algebraically, not exponentially, small as $t \to \infty$, by a function k(t, α) whose Fourier transform K (w, α) is regular in a strip of finite width enclosing the axis $\delta m\, w = 0$, and subsequently to allow α to tend to zero, when K (w, α) tends to the (discontinuous) transform of k (t). Author (ESRO)

N69-35559# Karlova Universita, Prague (Czechoslovakia).
ON THE S-TRANSFORMATION IN THE STRONG COUPLING THEORY
P. Exner and J. Tolar (Tech. Univ. of Prague) [1968] 8 p refs
(NP-17839) Avail: AEC Depository Libraries

The S-transformation is a unitary transformation accomplishing the main part of the diagonalization of the interaction Hamiltonian in strong coupling theories. For a compact symmetry group the action of the S-transformation on the integrals of motion is derived. Author (NSA)

N69-35583 Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.
COMPUTATION OF B AND L COORDINATES BY A PERTURBATION METHOD [CALCUL DES COORDONNEES B, L PAR UNE METHODE DE PERTURBATIONS]
G. Laval and R. Pellat *In* CERTS Determination of Radiation Doses in Space 1968 p 129-137 refs In FRENCH; ENGLISH summary Prepared jointly with CERTS (See N69-35578 20-29)
Copyright. Avail: Issuing Activity

McIlwain proposed a method for computing B and L coordinates, using a spherical harmonic expansion of the geomagnetic field. His method gives great accuracy, but with a computing-time which may become prohibitive. However, dose computations give, in most cases, an error of a few percent on the values of L. It is then possible to replace the direct computation by a perturbation method, in which the perfect dipole is the zero order approximation. In this way one can calculate the equational radius of the line of force passing through the point where the B and L coordinates are required and then compute L using the McIlwain formula applied to the equational point of the line of force. Author (ESRO)

N69-35602*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PERIODIC ORBITS IN TRIGONOMETRIC SERIES
Lloyd Carpenter Aug. 1969 32 p refs
(NASA-TM-X-63633; X-643-69-331) Avail: CFSTI CSCL 12A

A method is given for the study of families of periodic motion using trigonometric series to represent the individual solutions. The continuous deformations of a periodic orbit along a family are represented by the variations of the trigonometric coefficients with respect to a parameter. For the applications the series are truncated, while the coefficients and their variations are determined numerically. In this form, the continuation with respect to the parameter is given by a mapping $f: R^n \to R^n$ of the space of coefficients into itself. The values of the coefficients are then improved by another mapping which is a contraction operator in some neighborhood of the fixed point representing the solution. The method is applied to the natural families and to the families of the first and second kinds of Poincare in the restricted problem of three bodies. Author

N69-35624*# Georgia Univ., Athens.
A GENERALIZATION OF THE WEIBULL DISTRIBUTION
A. Clifford Cohen Huntsville, Ala. NASA Marshall Space Flight Center 31 Jul. 1969 23 p refs Revised
(Contract NAS8-11175)
(NASA-CR-61293; TR-31-Rev) Avail: CFSTI CSCL 12A

The two-parameter Weibull distribution with origin at zero and the three-parameter version of this distribution with origin at γ are widely employed as statistical models in connection with life testing. In this paper a four-parameter generalization of this distribution is introduced in order to provide a more versatile model for use in life studies and in related investigations. The problem of parameter estimation is considered and three separate sets of estimators are presented. These are (1) moment estimators, (2) maximum likelihood estimators, and (3) alternate estimators based on the first three moments and the first order statistic. Author

N69-35673# California Univ., Livermore. Lawrence Radiation Lab.
A BIBLIOGRAPHY ON APPROXIMATE MULTIDIMENSIONAL INTEGRATION, 1960 - 1968
F. N. Fritsch 5 Mar. 1969 20 p refs
(UCRL-50610) Avail: CFSTI

A bibliography of the literature of approximate multidimensional integration for the years 1960 to 1968 intended to supplement the bibliographies of Stroud is presented. It does not include Monte Carlo methods or numerical integration of functions of a single variable. Author (NSA)

N69-35687*# Purdue Univ., Lafayette, Ind. Dept. of Computer Sciences.
EFFICIENT COMPUTATION OF THE COMPLEX ERROR FUNCTION
Walter Gautschi 25 Jul. 1969 21 p refs Sponsored in part by Argonne Natl. Lab.
(Grant NGR-15-005-039)
(NASA-CR-105265) Avail: CFSTI CSCL 12A

The paper is concerned with the computation of $w(z) = \exp(-z^2)\mathrm{erfc}(-iz)$ for complex $z = x+iy$ in the first quadrant Q_1: $x \geq 0$, $y \geq 0$. Using Stieltjes' theory of continued fractions it is first observed that the Laplace continued fraction for $w(z)$, although divergent on the real line, represents $w(z)$ asymptotically for large z in the sector S: $-\pi/4 < \arg z < 5\pi/4$. Specifically, the n-th convergent approximates $w(z)$ to within an error of $O(z^{-2n-1})$ as $z \to \infty$ in S. A recursive procedure is then developed which permits evaluating $w(z)$ to a prescribed accuracy for any $z \in Q_1$. The procedure has the property that as $|z|$ becomes sufficiently large, it automatically reduces to the evaluation of the Laplace continued fraction. Author

N69-35702*# California Univ., Berkeley. Electronics Research Lab.
HYBRID CONJUGATE GRADIENT-STEEPEST DESCENT ALGORITHMS FOR UNCONSTRAINED MINIMIZATION
E. Messerli [1968] 25 p refs
(Grant NGL-05-003-016)
(NASA-CR-105421) Avail: CFSTI CSCL 12A

Three gradient-type procedures for unconstrained minimization are suggested. These procedures are hybrids between steepest descent and conjugate gradient algorithms, employing a design parameter to achieve adaptive sequence breaking. Essential convergence theory is presented in a unified fashion, and limited computational results are included to verify the efficacy of the form of the procedures. The computational results suggest that a normalized form of the Fletcher – Reeves algorithm is preferable to the original form. Author

N69-35703*# Connecticut Univ., Storrs. School of Engineering.
AN IMPROVED ALGORITHM FOR LEARNING SYSTEMS
R. N. Scott Aug. 1969 30 p refs
(Grant NGR-07-002-002)
(NASA-CR-105422) Avail: CFSTI CSCL 12A

An algorithm is developed for implementing a learning controller based on the concept of a subgoal. The method differs from previous work in that the state space need not be quantized, resulting in greatly reduced memory requirements and shorter learning times. It is applicable to linear stationary systems with unconstrained control variables, in which the system parameters are specified with uncertainty. A.C.R.

N69-35710# Stanford Univ., Calif. Dept. of Operations Research.
A BOUND-AND-SCAN ALGORITHM FOR PURE INTEGER LINEAR PROGRAMMING WITH GENERAL VARIABLES
Frederick S. Hillier 20 May 1969 130 p refs
(Contract Nonr-225(85); Grant NSF GP-7074)
(AD-688891; TR-11) Avail: CFSTI CSCL 12/2

The report presents the theory underlying the bound-and-scan algorithm for solving the pure integer linear programming problem with general integer variables. This algorithm proceeds by obtaining tight bounds or conditional bounds on the relevant values of the respective variables, and then identifying a sequence of constantly improving feasible solutions by scanning the relevant solutions. New encouraging computational experience is reported which suggests that this algorithm should compare favorably in efficiency with existing algorithms. Plans for investigating ways of further increasing the efficiency of the algorithm and of extending it to more general problems (including the mixed-integer case) also are outlined. The report also gives a listing of a new FORTRAN code for the algorithm and 30 new test problems. TAB

N69-35714# Vanderbilt Univ., Nashville, Tenn.
THE STRUCTURE OF ABELIAN P-GROUPS GIVEN BY CERTAIN PRESENTATIONS
Peter Crawley and Alfred W. Hales 1969 23 p refs Prepared in Cooperation with Calif., Inst. of Tech., Pasadena and Calif. Univ., Los Angeles
(Grants NSF GP-7252; NSF GP-5497)
(PB-184030) Avail: CFSTI

Abelian p-groups are described, generated by a set of elements subject only to relations of the form (p superscript n) $x = 0$ or (p superscript m) $x = y$. These groups shall be referred to as T-groups. The description of T-groups begins with the observation that both the maximal divisible subgroup and the reduced part of a T-group are again T-groups. Further it is proved that any two reduced T-groups having the same Ulm invariants are isomorphic. Necessary and sufficient conditions are obtained for a well-ordered sequence of cardinals to be the sequence of Ulm invariants of some reduced T-group. These results combined with Ulm's theorem yield that a reduced abelian p-group is a direct sum of countable groups if and only if it is a T-group whose length does not exceed the first uncountable ordinal. Author (USGRDR)

N69-35720*# Brown Univ., Providence, R.I.
ON THE CONTROL OF A LINEAR FUNCTIONAL-DIFFERENTIAL EQUATION WITH QUADRATIC COST
Harold J. Kushner and Daniel I. Barnea [1969] 27 p refs
(Grants NGR-40-002-015; AF-AFOSR-693-67; NSF GK-2788)
(NASA-CR-105321) Avail: CFSTI CSCL 12A

In using the theory of stochastic delay equations to study certain approximations to non-linear filters, and in order to stabilize a system when only noise corrupted observations are available, the problem of this paper becomes significant. Finding the control w of a linear difference-differential equation which minimizes the quadratic functional is demonstrated in five theorems, followed by proofs and notes defining necessary and unique conditions. The fifth theorem and its corollary contain the basic result of iteration in policy space and a further solution of the control w. Theorem six is the final optimization theorem and is applicable to the analysis of time lags in many analytical situations. M.H.E.

N69-35744*# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
FLOWS NEAR ISOLATED INVARIANT SETS IN DIMENSION 3
Robert Easton [1969] 11 p refs
(Grants NGL-40-002-015; AF-AFOSR-67-0693A; NSF GK-2788)
(NASA-CR-105398) CSCL 12A

The behavior of flows on 3-manifolds near isolated invariant sets is investigated. It is shown that if the invariant set is a circle (perhaps a periodic orbit), it is contained as a deformation retract in an isolating block which is a solid torus. Flows near isolated invariant sets which are points or tori are considered. It is shown that if T is an invariant set of a volume preserving flow ϕ on a 3-manifold and if ϕ/T is conjugate to an irrational flow on the torus, than T is not isolated. Author

N69-35756*# Texas Technological Coll., Lubbock. Dept. of Mathematics and Statistics.
EFFECTS OF DIGITAL APPROXIMATION IN STATISTICAL ESTIMATION Final Technical Report
Henry L. Gray, Truman O. Lewis, and Thomas L. Boullion [1969] 107 p
(Contract NAS9-8463)
(NASA-CR-101859) Avail: CFSTI CSCL 12A

The theoretical best estimators are in reality not the best estimators is established, and a simple method was developed which essentially compensates for this discrepancy between practical and theoretical results in the case of normal random variables. The useful effects of this correction factor are demonstrated on point and interval estimators. Similar results were established for the exponential distribution, and the necessary gound work for investigation of the distributional relationships between the truncated chi-square, T- and F-distributions were also confirmed. Author

N69-35760# National Physical Lab., Teddington (England). Div. of Numerical and Applied Mathematics.
BEHAVIOUR OF HESSIAN MATRICES OF BARRIER AND PENALTY FUNCTIONS ARISING IN OPTIMIZATION
W. Murray Apr. 1969 9 p refs
(NPL-Ma-77) Avail: Copyright. CFSTI

Minimization problems of matrices can be transformed into finding the minimum of a sequence of functions. The behaviour of the condition number of the Hessian matrix is investigated for a wide class of Barrier and Penalty functions. ESRO

N69-35767*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
DETERMINATION OF THE FREE OSCILLATIONS OF A CYLINDRICAL SHELL OF ELLIPTICAL CROSS SECTION [OPREDELENIYE CHASTOT SVOBODNYKH KOLEBANIY TSILINDRICHESKOY OBOLOCHKI ELLIPTICHESKOGO SECHENIYA]
E. I. Ivanyuta et al Washington NASA Aug. 1969 8 p refs Transl. into ENGLISH from Issled. Uprugosti Plast. (Leningrad), v. 1, 1964 p 46–51
(Contract NASw-1692)
(NASA-TT-F-12548) Avail: CFSTI CSCL 12A

A variational method is given for solving problems involving oscillations of a cylindrical shell, the primary advantage being that the frequency equation retains its form for all boundary conditions. Author

N69-35851# Michigan State Univ., East Lansing. Statistical Lab.
CONTRIBUTIONS TO COMPOUND DECISION THEORY AND EMPIRICAL BAYES SQUARED ERROR LOSS ESTIMATION
Richard John Fox Sep. 1968 79 p refs
(Grant NSF GP-7362)
(SLP-13 RM-214; RJF-1) Avail: Issuing Activity

Problems concerning compound decision theory, estimation of distribution functions, and empirical Bayes estimation are discussed. A test on the parameters of the exponential family for compound decision is also given. For discrete and continuous cases, compound testing procedures and estimators are included. Asymptotically optimal estimators are cited for one component of a two dimensional parameter indexing a bivariate exponential family. E.N.W.

N69-35857# Watervliet Arsenal, N.Y. Benet R and E Labs.
A GENERAL COMPUTATIONAL ALGORITHM FOR BAYESIAN CONFIDENCE BOUNDS, WITH APPLICATION TO THE WEIBULL, LOGNORMAL, AND GAMMA DENSITIES
Richard W. Clarke May 1969 39 p
(AD-688862; WVT-6911 Avail: CFSTI CSCL 14/4

The general Bayesian concept of random variables is introduced. Application of this concept to confidencing the reliability or safe life of a component is discussed. A computational algorithm which simplifies the calculations and which is applicable to almost any parameter space is presented. The necessary formulas are derived for application to the Weibull, lognormal, and gamma distributional forms. Author (TAB)

N69-35867*# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Sciences.
TIME AND FUEL OPTIMAL CONTROLS IN THE PRESENCE OF MEASUREMENT UNCERTAINTIES
Harold R. Dessau Jul. 1969 156 p refs
(Grant NGR-07-004-087)
(NASA-CR-105385; TR-3) Avail: CFSTI CSCL 12A

A class of stochastic optimal control problems associated with the task of controlling a rocket or space vehicle under circumstances of noisy measurements and strictly bounded control inputs is considered. Performance criteria of minimum time, minimum expected fuel consumption, and least upper bound fuel consumption are considered. Optimal feedback gains are precalculated in terms of the desired performance criterion, a priori known statistical information about the measurements and other random quantities, and the known system dynamics and constraints. The closed loop prestructured optimal control consists of a combination of the precalculated feedback gains and the history of noisy measurements on the system. Author

N69-35900# Purdue Univ., Lafayette, Ind.
AN ABSTRACT NON-LINEAR CAUCHY-KOVALEVSKA THEOREM
Francois Treves [1969] 41 p refs
(Grant NSF GP-07348)
Avail: Issuing Activity

A recent theory concerning hyperdifferential operators, linear partial differential equations with analytic coefficients, pseudoFokker-Planck equations, and singular operators in Banach space scales is extended to nonlinear conditions. The extension involves Cauchy problems where solution is sought in the class of analytic functions of the complex variable valued in a scale of Banach spaces. A.C.R.

N69-35908*# California Univ., Berkeley. Electronics Research Lab.
INPUT-OUTPUT PROPERTIES OF MULTIPLE-INPUT MULTIPLE-OUTPUT DISCRETE SYSTEMS, PART 2

M. Y. Wu and C. A. Desoer [1969] 43 p refs
(Grants NGL-05-003-016; AF-AFOSR-68-1488)
(NASA-CR-105420) Avail: CFSTI CSCL 12A

Input–output properties of nonlinear time-varying discrete systems are considered. Slightly generalized forms of the small gain and the passivity theorem are derived. Some results of Part I and these theorems are used to derive stability criteria. The memoryless nonlinearities and the multipliers are not required to be noninteracting. Author

N69-35918# International Centre for Theoretical Physics, Trieste (Italy).
BREMSSTRAHLUNG IN COULOMB FIELD: AN EXACT REGGE-MULTIPERIPHERAL PRODUCTION AMPLITUDE
C. Fronsdal and L. E. Lundberg May 1969 22 p refs Submitted for publication
(IC/69/33) Avail: CFSTI

The exact matrix elements for Coulomb scattering, photo-effect and bremsstrahlung in a Coulomb field are obtained by means of a very simple algebraic calculation. The method is closely related to current ideas on elementary particle physics, and Regge poles are particularly relevant in all three processes. Bremsstrahlung in a Coulomb field is a production amplitude that is given in its entirety by the contribution of a Reggeized multiperipheral diagram. Each internal line carries one value $\nu(E)$ of the Reggeized principal quantum number n, or equivalently, an infinite set of ordinary Regge poles with $\alpha(E) = \nu - 1, \nu - 2, \ldots$ This circumstance may be exploited to learn something about the Reggeon-Reggeon-particle vertex. Author (ESRO)

N69-35936# National Physical Lab., Teddington (England). Div. of Numerical and Applied Mathematics.
INDEFINITE QUADRATING PROGRAMMING
W. Murray Apr. 1969 11 p refs
(NPL-Ma-76) Copyright. Avail: CFSTI

Quadratic forms being considered indefinite are an extension to the functions considered in quadratic programming. The unconstrained minimum of a quadratic function is derived and dual problems are considered. Author (ESRO)

N69-35948*# Brown Univ., Providence, R.I. Center for Dynamic Systems.
THE INVERSION THEOREM AND PLANCHEREL'S THEOREM IN INFINITE DIMENSIONS
U. Haussmann 1969 33 p refs
(Grant NGL-40-002-051)
(NASA-CR-105399) Avail: CFSTI CSCL 12A

An assumed locally compact Abelian group with Haar measurement in a Banach space with a set of complex numbers is mapped onto a dense subset by using the Fourier transformation. This result is extended to functions taking values in an inner product subspace of a Banach algebra. This inversion theorem is generalized to functions assuming values in certain admissible Banach spaces. Existence and uniqueness theorems for some equations are proved. Author

N69-35954# International Centre for Theoretical Physics, Trieste (Italy).
INFINITE-COMPONENT FIELD THEORIES, FUBINI SUM RULES, COMPLETENESS AND CURRENT ALGEBRA. PART 2: MIXED SPECTRA
C. Fronsdal Apr. 1969 23 p refs Submitted for publication
Supported in part by NSF
(IC-69-23) Avail: CFSTI

Results reported previously for infinite-component field theories with discrete mass spectra are extended to the case of mixed spectra: partially discrete and partially continuous. A class of Majorana theories, including the Schrödinger theory of the hydrogen atom as well as relativistic models, is shown to satisfy normal completeness relations. As shown previously, this is equivalent to the existence of local current commutation relations and the possibility of constructing local fields. Space-like solutions contribute, but only those with real energy. A model without space-like solutions is shown to be non-local, and an attempt is made to estimate the extent of non-locality. It is possible to adjust the parameters so that the deviation from a strictly local current algebra becomes insignificant. Author (ESRO)

N69-35975# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
ELEMENTS OF A COMPATIBLE OPTIMIZATION THEORY FOR COUPLED SYSTEMS [ELEMENTS D'UNE THEORIE DE L'OPTIMISATION COMPATIBLE DE SYSTEMES COUPLES]
Alain Bonnemay (Ph.D. Thesis–Paris Univ., 6 Jun. 1968) Jun. 1969 203 p refs In FRENCH; ENGLISH summary
(CEA-R-3831) Avail: CFSTI

The first theory deals with the compatible optimization in coupled systems. A game theory for two players and with a non-zero sum is first developed. The conclusions are then extended to the case of a game with any finite number of players. After this essentially static study, the dynamic aspect of the problem is applied to the case of games which evolve. By applying Pontryagin's maximum principle it is possible to derive a compatible optimization theorem which constitutes a necessary condition. Author (ESRO)

N69-35988# Oxford Univ. (England). Dept. of Engineering Science.
SELF SIMILAR SOLUTIONS TO ADHESIVE CONTACT PROBLEMS WITH INCREMENTAL LOADING
D. A. Spence 1967 45 p refs
(REPT-1-031-67) Avail: CFSTI

The boundary value problem for axisymmetric distortion of an elastic half space by a rigid indentor is cast in the form of an integral equation of the Wiener-Hopf type. The solution is used to calculate stresses, displacements and contact radii for adhesive indentation by a flat faced cylinder, a sphere, and a cone and the results are compared with those obtained for frictionless indentation. Adhesive indentation of a half space by a rolling sphere (excluding dynamic effects) is also treated. ESRO

N69-36000# Duke Univ., Durham, N.C.
ON CONSTRUCTING A DISTRIBUTIVE LATTICE FROM A PARTIALLY ORDERED SET WITH DDC
David A. Smith Repr. from Commentat. Math. Univ. Carolinae, v. 9, Fasc. 4, Nov. 1968 p 515-525 refs
Avail: Issuing Activity

Notes on the theory of the imbedding of partially ordered sets in distributive lattices and particularly on imbedding which preserves local finiteness are presented. Interest in this relationship results from studies showing the relationship of one locally finite partially ordered set imbedding in another inducing an inbedding of their incidence algebras. The crown construction for distributive lattices with descending chain condition is attempted in three theorems for imbedding while preserving local finiteness. Proofs of this solution having several equivalent sufficient conditions are demonstrated. M.H.E.

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N69-34717# Massachusetts Inst. of Tech., Cambridge. Instrumentation Lab.

AIRBORNE TURBULENCE MEASURING SYSTEM DESIGN STUDY

Nigel H. Nathan, Norman Polner, Janusz Sciegienny, and Milton B. Trageser Jun. 1969 140 p refs

(Grant NSF GA-1124)

(R-640) Avail: Issuing Activity

The objective of the work was to conduct a design and feasibility study for an aircraft turbulence measurement system based on the Pace II inertial navigation system. An advanced state of the art system is proposed consisting of a gust data reference system interfaced with a remote meteorological instrument package. The reference system measures the position, velocity, and attitude of the gust probe mount with respect to the earth, and records this data and the meteorological instrument data on a real time basis. An optical measurement unit refers to the externally located gust probe of the inboard inertial measurement unit. The system mechanization, although oriented towards use of the WHOI C-54 aircraft and an available 15 foot vertical mast, is flexible enough not to be restricted to this particular aircraft or this particular configuration. In addition, the reference system can be used independently for other airborne applications requiring accurate position, velocity, and attitude data. Analysis covers system design, including velocity compensation of the gust probe data, and a technique for accurately aligning the inertial measurement unit in the aircraft prior to flight. Author

N69-34858# Environmental Science Services Administration, Silver Spring, Md.

HEMISPHERIC TELECONNECTIONS OF MEAN CIRCULATION ANOMALIES AT 700 MILLIBARS

James F. O'Connor Feb. 1969 103 p refs

(ESSA-TR-WB-10) Avail: SOD $1.00

Empirically derived composite maps are presented which show the probabilities of algebraic sign of the 700-mb height departures from normal around the hemisphere, depending on the season of the year and the algebraic sign of height anomaly centers at each 10° intersection of latitude and longitude, from 30° N. to 70° N. latitude, and from 40° W. to 180° longitude. These teleconnection maps indicate the probabilities of distant circulation anomalies associated with historical anomaly centers of a given algebraic sign at the various primary gridpoints. The maps are based on historical 5-day mean data for the years 1947–1963. These 5-day mean probability patterns were derived to provide an updated and more highly resolved historical background than was heretofore available for determination of typical configurations, wavelengths, and amplitudes of anomalous large-scale flows; for use in conjunction with conditional weather probabilities for extended periods; and for assessment of the plausibility of dynamical simulations based on numerical circulation models. Author

N69-34881*# Saint Thomas Univ., Houston, Tex. Inst. for Storm Research.

ANALYSIS OF WIND FIELD CONDITIONS ADVERSELY AFFECTING VEHICLE OPERATIONS Interim Report, March 1968 – March 1969

Joseph L. Goldman 28 Mar. 1969 103 p refs

(Contract NAS8-21292)

(NASA-CR-61286; Rept-61286) Avail: CFSTI CSCL 04B

Presented is an analysis of wind field conditions which could adversely affect vehicle operations, with particular application to the prospective launch sites at the Kennedy Space Center. Most turbulence models are based on ground wind data from meteorological towers. This report offers a means of diagnosing and predicting winds from both ground and satellite data. A theoretical model is developed whereby it is possible for the wind profile from the ground upward to be expressed as a function of the immediate past history of the CAOF forced flow. The principal theoretical contribution developed is in the friction layer, and these developments are made in anticipation of real-time forecasting. Also shown is the continuing development of an adverse wind washing system which is based on a theoretical and numerical model of airflow and which has been formulated and programmed for NASA computers. Author

N69-34898# RAND Corp., Santa Monica, Calif.

THERMAL CONVECTION IN THE ATMOSPHERIC BOUNDARY LAYER

C. B. Leovy Nov. 1968 28 p refs

(Contract NSF C-415)

(RM-5432-1-NSF; PB-183413) Avail: CFSTI CSCL 04B

A bulk heat transfer relation applicable to unstable conditions is proposed. The relation incorporates the assumptions that heat transfer near the surface is by molecular conduction, and the bulk transfer relation does not depend explicitly on the surface roughness characteristics, provided that roughness elements are not large compared with the thickness of the thermal boundary layer. The predicted heat flux compares favorably with heat transfer rates over a desert dry lake under conditions of extreme upward heat flux. The limiting case of vanishing surface stress is discussed, and the proposed formulation in this limit is compared with the heat transfer relation observed in laboratory experiments on parallel plate convection. Author (USGRDR)

N69-34900# Weather Bureau, Silver Spring, Md. Weather Analysis and Prediction Div.

REPORT ON WEATHER BUREAU FORECAST PERFORMANCE 1967–1968 AND COMPARISON WITH PREVIOUS YEARS

Charles F. Roberts, John M. Porter, and Geraldine F. Cobb Mar. 1969 50 p refs

(ESSA-TM-WBTM-FCST-11; PB-183366) Avail: CFSTI CSCL 04B

Analyses of data on weather forecast performance that have been developed from the forecast verification program of the Weather Bureau for 12 month periods are reported. In order to isolate seasonal variations in forecast performance, the data have been grouped into summer and winter periods. Author (USGRDR)

N69-34991# Forsvarets Forskningsanstalt, Stockholm (Sweden).

WIND VELOCITY MEASUREMENTS BY ACOUSTICS [AKUSTISK VINDHASTIGHETSMAETNING]

G. Hagelin Oct. 1967 33 p refs In SWEDISH

(FOA-3-C-3534-68) Avail: CFSTI

Some of the basic equations of the theory on acoustic wave propagation are reviewed in connection with preliminary experimental arrangements for wind velocity measurements. The pulse and phase methods are briefly discussed, including emplacement of sound transmitters and receivers and temperature compensation. Performance and limitations of acoustic anemometers are considered. An error analysis is outlined for adjusting nonlinearity of measurement, temperature factors, mechanical unsymmetry, and aerodynamic errors. A discussion of experimental equipment includes dimensioning, data for a Be-Ti tube pickup, and microphone designs. Transl. by K.W.

N69-35080# Swiss Inst. of Meteorology, Zurich.
RESULTS OF DAILY PRECIPITATION MEASUREMENT AT THE METEOROLOGICAL AND RAIN MEASUREMENT STATIONS OF SWITZERLAND, 1967 [ERGEBNISSE DER TAEGLICHEN NIEDERSCHLAGSMESSUNGEN AUF DEN METEOROLOGISCHEN UND REGENMESS-STATIONEN DER SCHWEIZ, 1967]
1968 291 p In GERMAN
Avail: CFSTI

Presented are daily and monthly mean precipitation measurements of Switzerland for the year 1967. Data tables contain measurements from about 127 meteorological stations and 343 rain stations. Transl. by G.G.

N69-35082# Swiss Inst. of Meteorology, Zurich.
CLIMATOLOGY OF SWITZERLAND. VOLUME C: AIR TEMPERATURE, PARTS 5-8 [KLIMATOLOGIE DER SCHWEIZ. C: LUFTTEMPERATUR, 5. BIS 8. TEIL]
M. Schueepp 1968 41 p In GERMAN
Avail: CFSTI

Monthly and yearly minimal and maximal temperature data of Switzerland are presented for the period 1901 to 1960. Data vary according to measurement localization; high Alpine valleys exhibit much more extreme temperature variations than the low country and the foothills. Transl. by G.G.

N69-35084# Institut Royal Météorologique de Belgique, Brussels. Régie des Voies Aériennes et Force Aérienne.
SYNOPTICAL OBSERVATIONS Monthly Bulletin, Apr. 1968 [OBSERVATIONS SYNOPTIQUES]
1969 31 p In FRENCH and DUTCH
Avail: CFSTI

Synoptical observations made from different meteorological stations in Belgium during April 1968 are presented. ESRO

N69-35070# Swiss Inst. of Meteorology, Zurich.
ANNALS OF THE SWISS CENTRAL METEOROLOGICAL INSTITUTE, 1967 [ANNALEN DER SCHWEIZERISCHEN METEORLOGISCHEN ZENTRALANSTALT, 1967]
1968 237 p refs In GERMAN
Avail: CFSTI

Data tables contain daily meteorological measurements on atmospheric temperatures, barometric pressures, relative humidity, wind direction and velocity, cloud covers, precipitation, and snow levels for Switzerland during 1967. Transl. by G.G.

N69-35085# Naval Weather Service, Washington, D.C.
US NAVAL WEATHER SERVICE WORLD-WIDE AIRFIELD SUMMARIES. VOLUME 8, PART 1: UNITED STATES OF AMERICA (WEST COAST, WESTERN MOUNTAINS, AND GREAT BASIN)
May 1969 564 p refs
(AD-688472) Avail: CFSTI CSCL 4/2

The volume is part of a series of compilations which is world-wide in scope. It consists of climatological summaries for selected airfields and for the climatic areas in which they are located. The volume provides climatological summaries for airfields and climatic areas in the United States. Summaries are arranged according to numbered climatic areas, and by increasing WMO Station Index Numbers within the climatic areas. An arbitrary station number is used where WMO Index Numbers are not assigned. Maps are included to delineate areas and station locations. Author (TAB)

N69-35116# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).
A DIMENSION ANALYSIS OF THE CONSTANT-FLUX LAYER
W. C. Swinbank *In* Sandia Corp. Atmospheric Turbulence and Diffusion in the Planetary Boundary Layer May 1968 p 183-198 refs (See N69-35102 20-13)
Avail: CFSTI

A number of relationships are derived by dimensional arguments which connect the vertical fluxes of heat and horizontal momentum in the constant-flux layer with the other relevant variables. Observations are used to test the correctness of the predicted relationships and to determine their functional form. The analysis emphasises the intimate connection between the transfers of the two quantities. Consideration of the air-sea exchange problem suggests that profile techniques are inappropriate. An alternative approach is presented, designed to provide estimates of the transfers of momentum and heat on a synoptic scale in terms of the differences in respective properties between the surface and the top of the friction layer. Author

N69-35120# Meteorological Office (Gt. Brit.)
SYMPOSIUM SUMMARY
F. Pasquill *In* Sandia Corp. Atmospheric Turbulence and Diffusion in the Planetary Boundary Layer May 1968 p 258-264 (See N69-35102 20-13)
Avail: CFSTI

Summarizing comments on the symposium are addressed to two questions: 1) how to evaluate new theories for application to the problems at hand, i.e., what physical and/or statistical models or equations to choose, and 2) how universal are experimental results. A critical attitude towards understanding of these results and the ability to put new results into a general, acceptable, rational frame of reference are recommended. A running discussion of issues continues with questions such as whether complex atmospheric processes can be described by simplification models, i.e., the diffusion model, and other questions basic to all scientific investigation are reviewed. M.H.E.

N69-35190# Bureau of Meteorology, Melbourne (Australia).
TROPICAL CYCLONES IN THE NORTHERN AUSTRALIAN REGIONS, 1966-1967 SEASON
May 1969 82 p
Avail: CFSTI

Tropical cyclones in the Northern, Northeastern, and Northwestern region of Australia for the season of 1966-67 are discussed. Tropical disturbances are allotted sequence numbers and classified as major cyclones with winds exceeding 33 knots and extending more than 100 miles from the center, tropical cyclones with winds exceeding 33 knots but not extending more than 100 miles from the center, and minor tropical disturbances with wind speeds not exceeding 33 knots. Case histories of tropical cyclones Beryl, Clara, Delilah, Edith, Elsie, Jane, and Laura are presented. Diagrams showing tracks of storms and central pressures are also included. Author

N69-35205# Weather Squadron (8th), Detachment 5, McCoy AFB, Fla.
TERMINAL FORECAST REFERENCE FILE, VOLUME 1
Jun. 1969 53 p refs
(AD-688580) Avail: CFSTI CSCL 4/2

Reference file for forecasters. Contains a description of the local area climatology, weather regimes, rules of thumb, and forecast studies. Author (TAB)

N69-35222# Environmental Technical Applications Center (Air Force), Washington, D.C.
RADAR-COMPUTED RAINFALL COMPARED WITH OBSERVATIONS FROM A DENSE NETWORK OF RAIN GAUGES
Martin Ross Jun. 1969 10 p refs
(AD-688434; ETAC-TN-69-4) Avail: CFSTI CSCL 4/2

Using Wilsons Rainfall Rate – Echo Intensity (RR-EI) chart, based on the average relationship, radar data collected for 36 hours, using the US Weather Bureaus WSR-57 at Atlantic City, New Jersey, are compared with rainfall data from three tipping-bucket rain gauges. These tipping-bucket gauges are located within 60 nm of the radar and cover a 4.8 square-mile area. Comparisons between the radar and tipping-bucket gauges are shown. Radar measurements were within 2% of the total rain gauge average. The correlation coefficient was .91. Use of the US Weather Bureaus RR-EI chart would have underestimated the average areal precipitation. Hourly rainfall amounts of 0.01 inches were detected in 80% of the cases. Hourly amounts of 0.02 inches or more were detected in 100% of the cases. Author (TAB)

N69-35244*# Bellcomm, Inc., Washington, D.C.
A LINEAR MODEL OF ATMOSPHERIC CIRCULATION
I. O. Bohachevsky 31 Jan. 1969 16 p refs
(Contract NASw-417)
(NASA-CR-104096; TM-69-1014-4) Avail: CFSTI CSCL 04B

A two-dimensional circulation pattern that may occur in an atmosphere, when the temperature does not vary with altitude in a layer near the surface of the planet, is described. The linear differential boundary value problem is formulated mathematically and the nature of the approximations is examined. The solution representing near isothermal circulation is presented; this motion is driven by a prescribed temperature distribution between subsolar and anti-solar points at the surface of the planet and at an altitude of about 10 km, where the existence of an absorbing layer is postulated. The discussion of radiative heat balance and of the absorption mechanism which maintains these temperature distributions is not included here. It is found that the flow pattern consists of three cells: the fluid circulates in opposite directions in two cells with heights equal to the extent of the isothermal layer; the third one, extending to infinity, is on top of the latter two. Author

N69-35263# Weather Bureau, Silver Spring, Md. Techniques Development Lab.
CONDITIONAL PROBABILITIES OF PRECIPITATION AMOUNTS IN THE CONTERMINOUS UNITED STATES
Donald L. Jorgensen, William H. Klein, and Charles F. Roberts Mar. 1969 95 p refs
(PB-183144; WBTM-TDL-18) Avail: CFSTI CSCL 04B

Conditional probabilities of precipitation are derived from a 15-year period of record for 108 selected stations within the 48 conterminous States. The probabilities are then computed for seven quantitative ranges in which amounts equal or exceed specified values. The investigation includes four 6-hour and two 12-hour periods, as well as one 24-hour period, with the data stratified by seasons. The resulting probabilities vary with station, season, and time of day. Application of the probabilities to weather forecasting is discussed. Additional precipitation characteristics and suggested applications are presented in the appendices. Author (USGRDR)

N69-35288# Travelers Research Center, Inc., Hartford, Conn.
TEST PLAN FOR IMPLEMENTATION FOR MULTI-STATION BOUNDARY LAYER MODEL SYSTEM
Apr. 1969 17 p
(Contract CWB-11256)
(PB-183516) Avail: CFSTI CSCL 04B

The Weather Bureau, Environmental Science Services Administration, has supported Travelers Research Corporation efforts in developing and testing a quasi-automated system of data processing and an automated physical-numerical model designated as the Multi-Station Boundary Layer Model System. The developmental tests demonstrated that the complex physical model could make realistic predictions of temperature, wind, water vapor and liquid water in the planetary boundary layer for periods of 1 to 12 hours. This document describes an implementation test of the Boundary Layer Model System in three phases, with the third phase being a real-time operational test of the system. Author (USGRDR)

N69-35290# Weather Bureau, Fort Worth, Tex. Scientific Services Div.
CLIMATOLOGY OF ATLANTIC TROPICAL CYCLONES BY TWO AND ONE HALF DEGREE LATITUDE-LONGITUDE BOXES
John R. Hope and Charles J. Neumann Feb. 1969 53 p refs
(PB-183308; WBTM-SR-44) Avail: CFSTI CSCL 04B

The paper presents a climatology and brief statistical analysis of Atlantic tropical storms and hurricanes by 2-1/2-degree latitude – longitude boxes. It extends and refines the climatological charts of Colon (1953) to include data for the years 1950–1968. The period of record used in this study extends from 1898 through 1968, a total of 83 years, and includes 687 storms and hurricanes passing through a total of 12,340 2-1/2-degree latitude – longitude boxes. Author (USGRDR)

N69-35295# Hawker Siddeley Dynamics, Ltd., Hatfield (England).
SMALL READ-OUT STATIONS FOR METEOROLOGICAL SATELLITES
N. E. Peach [1969] refs Presented at the 9th Brit. Interplanet. Soc. European Space Symp., London, 14–16 May 1969
Avail: CFSTI

Principal characteristics of equipment for small stations receiving and recording data from meteorological satellites are given. ESRO

N69-35308# Air Force Cambridge Research Labs., Bedford, Mass.
ESTIMATING THE PROBABILITY OF SUBCRITICAL UPPER-AIR WIND SPEEDS AND THEIR DURATION
Irving I. Gringorten *In its* Tethered Balloon Workshop Mar. 1969 p 31–41 refs (See N69-35301 20-02)
Avail: CFSTI

Questions to be answered are the nature of the probability that wind speed aloft, at given geographic location, altitude, and time of year, will not exceed a critical threshold speed for 12 hours, 48 hours, two weeks or other interval. Narrowed down, what would be the conditional probability that the threshold speed would not be exceeded in a subsequent time interval, if the speed was measured, and known, at time zero. The answers to these questions could be found by sorting a large sample of observations. But present practice is to measure wind speed aloft every 12 hours or, at some stations, every six hours. The empirical answer would not apply to continuous speeds. Moreover, meteorological records are too short, especially to provide stable values of conditional frequencies. It was found that the wind speeds, like many other meteorological variates, fit into a stationary Markov process. Consequently, it was profitable to develop a model of duration based on the Markov process, which yields the required estimates and answers to questions on the exceeding of threshold values. Author

N69-35346# National Severe Storms Lab., Norman, Okla.
STRUCTURE AND MOVEMENT OF THE SEVERE THUNDERSTORMS OF 3 APRIL 1964 AS REVEALED FROM RADAR AND SURFACE MESONETWORK DATA ANALYSIS
Jeww Charbe and Yoshikazu Sasaki Oct. 1968 53 p refs
(PB-183310; ERLTM-NSSL-41) Avail: CFSTI CSCL 04B

Detailed analyses of radar echoes, NSSL Betanetwork data and upper air soundings recorded on 3 April 1964 are made to investigate possible mechanisms of the movement of severe thunderstorms. From the analyses, it is apparent that the direction and speed of storm movement correlate directly with low-level inflow as described and characterized by the surface patterns of wind, pressure, temperature, and humidity, and also with storm rotation as indicated by the motion of small storm echo elements. Storm speed and direction to the right or left of the mean tropospheric wind can be explained as a result of combined effects of storm rotation, drag and propagation. Storm propagation is a result of a process of continuous intensification and subsequent displacement of convective activity to the side inflow side of the storm. Author (USGRDR)

N69-35348# Institut Royal Météorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS Monthly Bulletin, Apr. 1969 [OBSERVATIONS CLIMATOLOGIQUES]
1969 15 p In FRENCH and DUTCH
Avail: CFSTI

Climatological data derived from observations made at Uccle (Belgium) during April 1969 are presented. ESRO

N69-35364# Environmental Data Service, Silver Spring, Md.
MINIMUM TEMPERATURE PATTERNS OVER NEW YORK STATE ON TWO WINTER NIGHTS
A. Boyd Pack Feb. 1969 17 p
(PB-183398; EDSTM-7) Avail: CFSTI CSCL 04B

Changes in the minimum temperature as observed at numerous cooperative and first-order weather stations in New York State on two winter nights are described. The two nights were January 15, and January 17, 1965. Minimum temperatures were from 10 to 14 degrees F colder on the 17th than on the 15th in southwestern New York State and in the eastern Finger Lakes. Minima were warmer by a similar margin on the 17th in the eastern Adirondacks and Lake Champlain area. Interesting contrasts in the change of minimum temperatures between the two dates occurred among reporting stations in the western half of the State. The synoptic weather situation early on January 15, 1965, and developments that took place within the next 48 hours are discussed in some detail. Author (USGRDR)

N69-35446# National Environmental Satellite Center, Washington, D.C.
STATISTICAL ESTIMATION OF THE ATMOSPHERE'S GEOPOTENTIAL HEIGHT DISTRIBUTION FROM SATELLITE RADIATION MEASUREMENTS
William L. Smith Feb. 1969 36 p refs
(PB-183297; ESSA-TR-NESC-48) Avail: CFSTI CSCL 04B

A statistical procedure is formulated for estimating geopotential height and temperature profiles from satellite radiation measurements, particularly from those to be made by the satellite infrared radiation spectrometer which is to fly on the Nimbus 3 meteorological satellite. Regression relations between radiance, temperature, and geopotential height are derived, a method for minimizing the influence of clouds on the solutions is described, and the statistical procedure for computing the height and temperature profiles from the regression equations and satellite observations of radiance is presented. Synthetic radiance observations from radiosonde measurements are used to test the statistical procedure. Author (USGRDR)

N69-35518# Weather Squadron (15th), Detachment 22, Tinker AFB, Okla.
TERMINAL FORECAST REFERENCE FILE, TINKER AFB, OKLA. Final Report
Jan. 1969 53 p refs
(AD-683876) Avail: CFSTI CSCL 4/2

The reference file discusses factors affecting the weather at Tinker AFB, OK. Included are location and topography, weather controls, climatic aids and local forecast studies. Author (TAB)

N69-35523*# National Aeronautics and Space Administration, Washington, D.C.
RESPONSE CHARACTERISTICS OF METEOROLOGICAL ROCKET WIND REDUCTION TECHNIQUES
Alvin J. Miller (ESSA, Hillcrest Heights, Md.) Aug. 1969 14 p refs
(NASA-TM-X-1850) Avail: CFSTI CSCL 04B

By use of analytical expressions for position and time as functions of height the response characteristics of the height-based and time-based manual wind reduction techniques for meteorological rocketsondes are deduced. It is shown that the height-based method is more consistent in depicting medium-scale perturbations than is the time-based method. This is accomplished, however, at the expense of the simplicity of the time-based system. Author

N69-35528*# GCA Corp., Bedford, Mass.
INFERENCE OF STRATOSPHERIC TEMPERATURE AND MOISTURE PROFILES FROM OBSERVATIONS OF THE INFRARED HORIZON Final Report
Frederick B. House and George Ohring Washington NASA Aug. 1969 62 p refs
(Contract NAS1-7572)
(NASA-CR-1419; GCA-TR-69-5-N) Avail: CFSTI CSCL 04B

The feasibility of inferring temperature and moisture profiles in the stratosphere from horizon radiances in the 15 micron CO_2 band and the H_2O rotational band was studied. Investigations are performed of inversion techniques, absorption band structures, error analyses and problems related to instrument design. A relatively simple inference method termed the instant inversion technique is developed and applied successfully to both theoretical radiance profiles and observed orison radiances from Project Scanner. A detailed analysis of these inversion results leads to a recommended measurement and data reduction technique to determine both temperature and moisture profiles in the stratosphere and lower mesosphere. Author

N69-35532# National Severe Storms Lab., Norman, Okla.
A STUDY OF A SEVERE LOCAL STORM OF 16 APRIL 1967
George Thomas Haglund (M.S. Thesis-Washington Univ., Seattle) May 1969 60 p refs
(ERLTM-NSSL-44) Avail: CFSTI

A large amount of data was available on the central Oklahoma storm, including mesonetwork data, serial soundings at five locations in central Oklahoma, and weather radar observations. The synoptic and mesoscale analyses showed that the storm began under marginal conditions for a convective outbreak, but that a dry line and weakening cold front contributed to the initial development. At the time the storm first appeared on radar, the dry line had almost been overtaken by the weakening cold front and consisted of eastward-extending pockets of dry air, rather than a continuous line. The structure and the direction of movement of the storm are analyzed in detail. Author

N69-35545# Environmental Science Services Administration, Miami, Fla. National Hurricane Research Lab.
A KINETIC ENERGY BALANCE IN A DEVELOPING TROPICAL DISTURBANCE
Clark L. Smith Mar. 1969 33 p refs
(ESSA-TM-ERLTM-NHRL-84; PB-183298) Avail: CFSTI CSCL 04B

The terms of the mechanical energy equation were evaluated for five map times, for two volumes of vertical extent 1000-550 mb and 1000-250 mb, to clarify the energy releasing processes of a developing tropical disturbance. Initially, boundary work sustained the disturbance. Later, conversion from potential to kinetic energy in the high troposphere was the main intensification mechanism. Author (USGRDR)

N69-35570*# Pennsylvania State Univ., University Park.
INVESTIGATION OF THE TURBULENT WIND FIELD BELOW 150-METER ALTITUDE AT THE EASTERN TEST RANGE
Alfred K. Blackadar, John A. Dutton, H. A. Panofsky, and Anton Chaplin Washington NASA Aug. 1969 105 p refs
(Contract NAS8-21140)
(NASA-CR-1410) Avail: CFSTI CSCL 04B

The development of suitable analytical and empirical models for studying the characteristics of wind near the ground as a source of aerodynamic loads imposed on vehicles during launch operations is discussed. Factors affecting the structure of the wind, wind shear, and associated turbulence so as to permit predictions about the statistical effects of wind on space vehicles, both on the launch pad and during the first few moments of flight are also investigated. Statistical models of the turbulent environment constructed on the basis of the climatology of the relevant parameters are presented. Author

N69-35665# Institut Royal Météorologique de Belgique, Brussels. Régie des Voies Aériennes et Force Aérienne.
SYNOPTICAL OBSERVATIONS Monthly Bulletin, Mar. 1968 [OBSERVATIONS SYNOPTIQUES]
1969 31 p In FRENCH and DUTCH
Avail: CFSTI

Synoptical observations made from different meteorological stations in Belgium during March 1968 are presented. ESRO

N69-35905# National Environmental Satellite Center, Washington, D.C.
VIDICON DATA LIMITATIONS
Arthur Schwalb and James Gross Jun. 1969 27 p refs
(NESCTM-17) Avail: CFSTI

A brief summary of observations of vidicon camera operation for remote sensing of meteorological phenomena, as well as description of techniques used in camera calibration and evaluation both before and after spacecraft launch, is presented. Particular emphasis is placed on demonstrating the limitations of the data, whether originating in the camera system or resulting from processing. A.C.R.

N69-35913# Institut Royal Météorologique de Belgique, Brussels. Régie des Voies Aériennes et Force Aérienne.
SYNOPTICAL OBSERVATIONS Monthly Bulletin, Feb. 1968 [OBSERVATIONS SYNOPTIQUES Bulletin Mensuel, Fevrier 1968]
1969 30 p In FRENCH and DUTCH
Avail: CFSTI

Synoptical observations made from different meteorological stations in Belgium during February 1968 are presented. ESRO

N69-35955# Institut Royal Météorologique de Belgique, Brussels. Régie des Voies Aériennes et Force Aérienne.
SYNOPTICAL OBSERVATIONS Monthly Bulletin, Jan. 1968 [OBSERVATIONS SYNOPTIQUES]
1969 29 p In FRENCH and DUTCH
Avail: CFSTI

Synoptical observations made from different meteorological stations in Belgium during January 1968 are presented. ESRO

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N69-34672*# Analytic Sciences Corp., Reading, Mass.
DESIGN OF STRAPDOWN GYROSCOPES FOR A DYNAMIC ENVIRONMENT Interim Scientific Report
Arthur A. Sutherland, Jr. and William S. Beebee Washington NASA Aug. 1969 186 p refs
(Contract NAS12-508)
(NASA-CR-1396; TR-101-4; ISR-2) Avail: CFSTI CSCL 17G

Some aspects of the analysis of vibration-induced attitude errors in strapdown inertial navigators are discussed. Three common pulse torquing techniques for strapdown gyros are described. The important considerations in choosing a rebalance scheme are reviewed and relative advantages of the three approaches are discussed. Binary and ternary pulse rebalanced gyros are analyzed using describing functions. Closed loop sinusoidal transfer characteristics are obtained analytically and compared with the results of detailed gyro simulations. The effects of compliance between the gyro wheel and gimbal are also illustrated by analysis and simulation. Compensation of limit cycling binary torqued gyros is treated with the goal of providing a better closed loop response. A discussion of the dithered binary gyro is presented, illustrating limit cycle determination and closed loop characteristics. The appendices provide details in support of the report body and also treat diverse subjects such as dynamic errors in single-degree-of-freedom pendulous accelerometers, gyro misalignment caused by angular rates about the output axis and the recovery of angular rate information from pulse torqued gyros. Author

N69-34714# Dornier-Werke G.m.b.H., Munich (West Germany).
LANDING VTOL AIRCRAFT IN ALL WEATHERS
F. Grochowski *In its* Dornier-Post, No. 2-3, 1968 [1969] p 12-15 (See N69-34713 20-02)
Avail: CFSTI

Meteorological and runway requirements for V/STOL aircraft landing and evaluation of special existing and proposed landing aid systems are discussed. ESRO

N69-34950*# TRW Systems Group, Redondo Beach, Calif.
A STUDY OF GUIDANCE MODES FOR A UNIFIED GUIDANCE SYSTEM Interim Report

C. G. Pfeiffer and W. H. Berry 31 Mar. 1969 175 p refs
(Contract NAS 12-593)
(NASA-CR-86201) Avail: CFSTI CSCL 17G

General space guidance theory and practice are discussed. Different types of powered flight guidance algorithms (modes) are classified and performance characteristics of the classes are considered. Illustrative simulation results are presented to compare the performance of the iterative guidance mode and the hybrid guidance mode with the calculus of variations solution. Certain problems which must be solved before a truly unified guidance system can be developed are identified and discussed in detail. Author

N69-35155# National Weather Records Center, Asheville, N.C.
CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 9: CINCINNATI, OHIO, GREATER CINCINNATI AIRPORT Final Report
Jun. 1969 32 p
(FAA Order FA-67-WAI-129)
(SRDS-RD-69-22-Vol-9) Avail: Issuing Activity

Tabulated data covering the period 1 January 1956 to 31 December 1965 are presented for the Cincinnati airport. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Weather and landing system categories are tabulated as aids for making decisions affecting landing system and fog dissipation at the air terminal. Author

N69-35156# National Weather Records Center, Asheville, N.C.
CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 11: COLUMBUS, OHIO, PORT COLUMBUS INTERNATIONAL AIRPORT Final Report
Jun. 1969 32 p
(FAA Order FA-67-WAI-129)
(SRDS-RD-69-22-Vol-11) Avail: Issuing Activity

Tabulated data covering the period 1 January 1956 to 31 December 1965 are presented for the Columbus airport. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Weather and landing system categories are tabulated as aids for making decisions affecting landing system and fog dissipation at the air terminal. Author

N69-35157# National Weather Records Center, Asheville, N.C.
CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 12: DALLAS, TEXAS, LOVE FIELD Final Report
Jun. 1969 32 p
(FAA Order FA-67-WAI-129)
(SRDS-RD-69-22-Vol-12) Avail: Issuing Activity

Tabulated data covering the period 1 January 1956 to 31 December 1965 are presented for the Dallas airport. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Weather and landing system categories are tabulated as aids for making decisions affecting landing system and fog dissipation at the air terminal. Author

N69-35158# National Weather Records Center, Asheville, N.C.
CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 13: DAYTON, OHIO, JAMES M. COX MUNICIPAL AIRPORT Final Report
Jun. 1969 32 p
(FAA Order FA-67-WAI-129)
(SRDS-RD-69-22-Vol-13) Avail: Issuing Activity

Tabulated data covering the period 1 January 1956 to 31 December 1965 are presented for the Dayton airport. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Weather and landing system categories are tabulated as aids for making decisions affecting landing system and fog dissipation at the air terminal. Author

N69-35159# National Weather Records Center, Asheville, N.C.
CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 14: DENVER, COLORADO, STAPLETON INTERNATIONAL AIRPORT Final Report
Jun. 1969 32 p
(FAA Order FA-67-WAI-129)
(SRDS-RD-69-22-Vol-14) Avail: Issuing Activity

Tabulated data covering the period 1 January 1956 to 31 December 1965 are presented for the Denver airport. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Weather and landing system categories are tabulated as aids for making decisions affecting landing system and fog dissipation at the air terminal. Author

N69-35160# National Weather Records Center, Asheville, N.C.
CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 15: DETROIT, MICHIGAN, DETROIT METROPOLITAN-WAYNE COUNTY AIRPORT Final Report
Jun. 1969 32 p
(FAA Order FA-67-WAI-129)
(SRDS-RD-69-22-Vol-15) Avail: Issuing Activity

Tabulated data covering the period 1 January 1956 to 31 December 1965 are presented for the Detroit airport. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Weather and landing system categories are tabulated as aids for making decisions affecting landing system and fog dissipation at the air terminal. Author

N69-35161# National Weather Records Center, Asheville, N.C.
CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 16: HARTFORD, CONNECTICUT, BRADLEY INTERNATIONAL (WINDSOR LOCKS) AIRPORT Final Report
Jun. 1969 32 p
(FAA Order FA-67-WAI-129)
(SRDS-RD-69-22-Vol-16) Avail: Issuing Activity

Tabulated data covering the period 1 January 1956 to 31 December 1965 are presented for the Hartford airport. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Weather and landing system categories are tabulated as aids for making decisions affecting landing system and fog dissipation at the air terminal. Author

N69-35162# National Weather Records Center, Asheville, N.C.
CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 17: HOUSTON, TEXAS, WILLIAM P. HOBBY AIRPORT Final Report

Jun. 1969 32 p
(FAA Order FA-67-WAI-129)
(SRDS-RD-69-22-Vol-17) Avail: Issuing Activity

Tabulated data covering the period 1 January 1958 to 31 December 1965 are presented for the Houston airport. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Weather and landing system categories are tabulated as aids for making decisions affecting landing system and fog dissipation at the air terminal. Author

N69-35331# Royal Greenwich Observatory, Herstmonceux (England). H.M. Nautical Almanac Office.
CORRECTIONS, FOR IRRADIATION, TO THE OBSERVED ALTITUDE OF THE SUN
W. A. Scott and D. H. Sadler Jan. 1967 20 p refs
(NAO-TN-12) Avail: CFSTI

An analysis of 7820 observations gives a mean value of the difference of the irradiation corrections for the upper and lower limbs of the Sun of about +0.'1. This differs significantly from the currently adopted value of +1.'2, which was deduced from observations made at very low altitudes. A series of 668 observations made specially at low altitudes by officers at H.M.S. Dryad gives a mean value of about +0.'8, and strongly suggests that the difference increases sharply as the altitude decreases below 10°. It is concluded that there is little justification for retaining the present correction of −1.2 in the altitude-correction tables for the upper limb of the Sun as given in 'The Nautical Almanac'. Author (ESRO)

N69-35347# Rome Univ. (Italy). Scuola di Ingegneria Aerospaziale.
DRIFT COMPONENTS IN GYROSCOPIC SYSTEMS FOR INERTIAL GUIDANCE [COMPONENTI DI DRIFT IN SISTEMI GIROSCOPICI DI TIPO INERZIALE]
Gianfranco Mansrani Feb. 1969 65 p In ITALIAN; ENGLISH summary *Its* Atti del Centro Ric. Aerospaziali 20
Avail: CFSTI

A theoretical study of the drift components of a three-axis gyro assembly for an inertial guidance system is presented. The theoretical transient behavior of a static feedback signal applied to the output axis of each gyro is also discussed. ESRO

N69-35470# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPTIMUM SIGNAL CONVERSION IN AN ASTROINERTIAL SYSTEM
Yu. N. Khenin et al 20 Feb. 1969 15 p refs Transl. into ENGLISH from Tr. Lewingr. Politekhn. Inst. (Moscow), no. 266, 1966 p 119–125
(AD-687232; FTD-MT-24-429-68) Avail: CFSTI CSCL 17/7

The problem of continuous determination of the coordinate S(T), which is measured on the earth's surface along the arc of the great circle from point A to point B (where the object is located) is examined. A single-channel astro-inertial system is used. The principle of minimum error dispersions is used as the test of optimalness in solving the problem of synthesis of the dynamic characteristics of optimal conversion ensuring a minimal total error. Three limiting cases are examined: (1) the initial coordinate is known precisely and the mean velocity is known with low accuracy; (2) the initial coordinate is practically unknown and the mean velocity is known very accurately; (3) neither value is known. All of the results pertain to operating times of up to 1000 sec and on the order of tens and hundreds of hours. TAB

N69-35478*# TRW Systems Group, Redondo Beach, Calif. Atmospheric Flight Mechanics Section.
LOW SPEED REENTRY GUIDANCE DISPERSION EVALUATION
F. G. Skerbetz and M. I. Cruz 29 Jul. 1969 36 p refs
(Contract NAS9-8166; Proj. Apollo)
(NASA-CR-101870; TRW-11176-H308-R0-00; TRW-69-FMT-764) Avail: CFSTI CSCL 17H

A set of partial derivatives relating entry guidance errors to touchdown dispersions is presented. Two sources of errors were studied, i.e., guidance system initialization errors at the entry interface and inertial measurement unit (IMU) hardware errors. These two error sources were taken independently of each other and no attempt was made to couple the error sources. This study is applicable to Apollo guided entries with entry velocities less than 27,000 feet per second and for realistic values of the error sources considered. Three sets of partial derivatives are presented and of these three only the Navigation Actual (NAV ACT) partials are constant with respect to error magnitude. The NAV-ACT partial is the most significant because it does not contain the effect of the perturbation on the random control errors. The other two sets of partials, both of which contain the perturbation's effect on the control error, are presented for information purposes only. Author

N69-35484*# Techtran Corp., Glen Burnie, Md.
GENERAL PROBLEMS OF GUIDANCE THEORY [OBSCHIE VOPROSY TEORII NAVEDENIYA]
Ye. A. Fedosov, A. M. Batkov, V. F. Levitin, and V. A. Skrinkin Washington NASA Aug. 1969 20 p refs Transl. into ENGLISH from IFAC Tech. Session no. 57 (Warsaw), 16–[illegible] Jun. 1969 p 143–165
(Contract NASw-1695)
(NASA-TT-F-12498) Avail: CFSTI CSCL 17G

The concept of guidance systems and the general methods for its optimization are explained. An attempt is made to formulate a single approach to the calculation of guidance systems of various classes of objects in motion when they are performing the task of pursuing a target. It is based on the general concept of guidance systems and the sole mathematical formulation of the problem of synthesizing an equation system applicable to various types of objects in motion, characteristics of targets, and information used concerning the phase coordinates of the objects. Author

N69-35529*# Techtran Corp., Glen Burnie, Md.
STATISTICAL SYNTHESIS OF OPTIMAL PULSE CONTROL SYSTEMS FOR SPACECRAFT WITH CONSIDERATION OF STRUCTURAL LIMITATIONS OF THE SYSTEM [STATISTICHESKIY SINTEZ OPTIMALNYKH IMPULSNYKH SISTEM UPRAVLENIYA KOSMICHESKIKH OBYEKTEV S UCHETOM OGRANICHENIY PO STRUKTURE SISTEMY]
A. Ye. Andriyenko Washington NASA Aug. 1969 12 p refs Transl. into ENGLISH from IFAC Tech. Session no. 49 (Warsaw), 18–21 Jun. 1969 p 101–114
(Contract NASw-1695)
(NASA-TT-F-12492) Avail: CFSTI CSCL 17G

Statistical methods are presented for the synthesis of pulse systems with consideration of limitations imposed on the structure. There are three types of such limitations: (1) limitation on memory capacity of controlling system; (2) limitation on the number of systems that reproduce the coefficients of the algorithm of operation of the controlling system; and (3) limitation on the type of operations that can be accomplished in the controlling system. These methods are applied to systems of terminal control, including several classical control systems for aerospacecraft and their power plants. Author

N69-35902*# Polhemus Associates, Inc., Ann Arbor, Mich.
NAVIGATION TRAFFIC CONTROL SYSTEM FOR VTOL AND STOL AIRCRAFT (NAVTRACS) Interim Report
5 Dec. 1968 29 p
(Contract NAS12-2024)
(NASA-CR-86215) Avail: CFSTI CSCL 17G

Graphic outlines and diagrams are presented of a navigation and control systems for VTOL and STOL aircraft. Block diagrams depict the study approach and organizational as well as operational features of the program. G.G.

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N69-34825# California Univ., Berkeley. Lawrence Radiation Lab.
DESIGN AND CONSTRUCTION OF THE AXIAL INJECTION SYSTEM FOR THE 88-INCH CYCLOTRON
D. J. Clark, R. Burger, A. Carneiro, D. Elo, P. Frazier et al Mar. 1969 10 p refs
(Contract W-7405-eng-48)
(UCRL-18608) Avail: CFSTI

A new axial injection system for the 88-inch cyclotron has been constructed. It transports beams from external ion sources axially through the magnet yoke to the median plane of the cyclotron. The optical elements include a bending magnet, electric quadrupoles, and the the magnetic field of the cyclotron. Beam monitoring is done with scanning wires, phosphor plates and Faraday cups. Author (NSA)

N69-34826# California Univ., Livermore. Lawrence Radiation Lab.
EXTENSION OF THE ASTRON ACCELERATOR TO 8 MeV
Kenneth A. Saunders 27 Mar. 1969 12 p refs Presented at Symp. on Eng. Probl. of Fusion Res., Los Alamos, N.Mex., 8-11 Apr. 1969 Sponsored by AEC
(UCRL-71568; CONF-690407-13) Avail: CFSTI

The increase in beam energy from 4 to 8 MeV requires essentially doubling the number of magnetic cores in the Astron accelerator at Lawrence Radiation Laboratory, University of California, Livermore. These cores are reconnected so that each pulser drives two cores in series instead of using a pulser for each core. Doubling the magnetic material results in a lower excitation current, thus providing a higher accelerating potential from each of the pulse generators. In this way the beam energy is doubled, with the major addition being passive components and a very modest increase in active electronics. Author (NSA)

N69-34799# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
DETECTION OF INCIPIENT FAILURE IN NUCLEAR REACTOR PRESSURE SYSTEMS USING ACOUSTIC EMISSION
P. H. Hutton Apr. 1969 38 p refs
(Contract AT(45-1)-1830)
(BNWL-997) Avail: CFSTI

Development work to apply acoustic emission detection as a means of continuously monitoring nuclear reactor pressure boundaries for flaw formation and/or growth is summarized. The nature of the acoustic emission signal has been clarified, specialized detection techniques have been developed, identification of acoustic emission in the presence of hydraulic noise has been demonstrated, and the technique has been beneficially applied to selected problems both in the field and in the laboratory. Author (NSA)

N69-34860# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
PANEL TO THE 10th ANNIVERSARY OF THE REACTOR WWR-S IN NUCLEAR RESEARCH INSTITUTE REZ, CSSR
26 Sep. 1967 53 p refs
(UJV-1906) Avail: AEC Depository Libraries

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N69-34861# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
TEN YEARS OF THE RESEARCH NUCLEAR REACTOR OF THE NUCLEAR RESEARCH INSTITUTE, CZECHOSLOVAK ACADEMY OF SCIENCES
M. Capek and F. Musilek *In its* Panel to the 10th Anniv. of the Reactor WWR-S in Nucl. Res. Inst. Rez, CSSR 26 Sep. 1967 7 p (See N69-34860 20-22)
Avail: AEC Depository Libraries

Research studies reported with the nuclear reactor cover the following fields: (1) radioisotope production and irradiation service; (2) neutron and reactor physics experiments; and (3) reactor technological developments. Gas and water loops installed in the reactor made it possible to observe electrical field effects on heat transfer into the coolant and to study the effects of uranium rods upon the temperature field. Automatic start-up and regulation of the reactor power with the help of movable detectors constituted an important modernizing factor in reactor monitoring. G.G.

N69-34862# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
THE ASSERTION OF THE WWR-S REACTOR OF THE NUCLEAR RESEARCH INSTITUTE (UJV) IN REZ FOR THE NUCLEAR POWER RESEARCH
V. Kraus, J. Markvart, E. Pelcik, B. Stoces, and V. Zajic *In its* Panel to the 10th Anniv. of the Reactor WWR-S in Nucl. Res. Inst. Rez, CSSR 26 Sep. 1967 6 p (See N69-34860 20-22)
Avail: AEC Depository Libraries

Research with the carbon dioxide cooled reactor centered on the evaluation of physical properties of irradiated construction materials and the influence of annealing on the reconstruction of the original properties of these irradiated materials. An experimental verification of a design for the biological shielding top of a power reactor was realized from the results of these experiments. G.G.

N69-34863# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.

PRODUCTION OF RADIOISOTOPES IN THE INSTITUTE OF NUCLEAR RESEARCH OF THE CZECH. ACADEMY OF SCIENCES IN THE YEARS 1957 - 1967

P. Simek *In its* Panel to the 10th Anniv. of the Reactor WWR-S in Nucl. Res. Inst. Rez, CSSR 26 Sep. 1967 8 p (See N69-34860 20-22)

Avail: AEC Depository Libraries

Reported radioisotope production from irradiated target materials is described for P_{32}, S_{35}, I_{131}, Au_{198}, as well as the production of compounds containing the radioisotopes Na_{24}, K_{42}, Br_{82}, and Hg_{203}. The target materials for the production are activated in the vertical canals of the reactor core in aluminum cells capsules. The unfavorable expenditure profit ratio of the production program is caused by too small working groups, standard operational procedures, and the regard to isotope production as a byproduct of research activities. G.G.

N69-34864# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.

EXPERIMENTAL WORK IN THE REACTOR WWR-S IN THE FIELD OF NEUTRON PHYSICS

J. Kajfosz *In its* Panel the 10th Anniv. of the Reactor WWR-S in Nucl. Res. Inst. Rez, CSSR 26 Sep. 1967 11 p (See N69-34860 20-22)

Avail: AEC Depository Libraries

Described is the installation of basic experimental equipment for neutron beam work and the development of electronics for scintillation detectors, as well as various studies in neutron physics. Most important experiments pertain to: (1) radiation capture spectra of thermal neutrons; (2) spin determination for Cl^{35} resonance; (3) correlation function on isotope Ti^{49}; (4) circular polarization measurements on high energy transitions from captured states; (5) gamma radiation measurements with germanium–lithium detectors on capture reactions; and (6) neutron absorption measurements in fuel elements. G.G.

N69-34865# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.

THERMAL NEUTRON ENERGY SPECTRUM IN THE ELEMENTARY CELL OF THE WWR-S REACTOR

M. Hron and J. Vanicek *In its* Panel to the 10th Anniv. of the Reactor WWR-S in Nucl. Res. Inst. Rez, CSSR 26 Sep. 1967 13 p refs (See N69-34860 20-22)

Avail: AEC Depository Libraries

Spectra of thermal neutrons in the elementary cell of a light water moderated reactor were calculated by means of computation codes for slab geometry and for the cylindrical geometry written in ALGOL. Effective neutron temperatures obtained through these methods are depicted in table form. Results are compared to another calculation and to measured values. The spectrum calculated by means of the scattering kernel of the gaseous model was softer than the measured one. However, the use of the calculated thermal neutron spectrum for averaging nuclear effective cross sections led to more accurate physical calculations on the light water moderated reactor. Author

N69-34908# United Kingdom Atomic Energy Authority, Risley (England). Health and Safety Branch.

SURVEY OF DEFECTS IN PRESSURE VESSELS BUILT TO HIGH STANDARDS OF CONSTRUCTION AND ITS RELEVANCE TO NUCLEAR PRIMARY CIRCUIT ENVELOPES

C. A. G. Phillips and R. G. Warwick 1968 36 p refs

(AHSB(S)-R-162) Avail: CFSTI; UK 6s

The first stage is reported of a survey of defects in Class I-constructed pressure vessels. The implications of the results are analyzed and their relevance to nuclear primary circuit envelopes assessed. A review of defined normal operational failures in British and American reactor primary circuit envelopes is included for comparison with relevant incidents in conventional vessels. Author (NSA)

N69-34921# Brookhaven National Lab., Upton, N.Y. Nuclear Engineering Dept.

MIXING EFFECTS IN CHEMICAL REACTORS. PART 2: RADIATION-INDUCED CHAIN REACTORS IN FLOW SYSTEMS

R. M. Felder and F. B. Hill May 1969 47 p refs Presented at Ann. Am. Inst. of Chem. Engr. Conf., Los Angeles Sponsored by AEC

(BNL-12519; CONF-681212-1) Avail: CFSTI

It has been reported previously that radial mixing or diffusion of reactant in a continuous tubular reactor tends to enhance reactor performance. This was the result of a single-step n^{th}-order reaction ($n \geq 0$), an arbitrary residence time distribution, and an arbitrary dependence of the specific rate constant on position in the reactor. Similar results were obtained for a chain reaction in which radial mixing of radicals and/or reactants may occur. Necessary and sufficient conditions for the existence of a radical mixing effect on reactor performance are derived, and the direction of such an effect is established. Illustrative results are presented for a continuous annular photoreactor in which nonuniform absorption of radiation leads to an inhomogeneous local reaction rate. The influences on reactor performance of the residence time distribution, the spatial reaction rate nonuniformity, and the presence of reactant and radical mixing are demonstrated. Author (NSA)

N69-34935# Societe Belge pour l'Industrie Nucleaire, Brussels (Belgium).

IRRADIATION OF MIXED UO_2–PuO_2 FUELS IN THE BR-3 PRESSURIZED-WATER REACTOR. Final Report [IRRADIATION DE COMBUSTIBLES MIXTES UO2-PuO2 DANS LE REACTEUR BR-3/PWR Rapport Final]

A. Lhost and H. Bairiot Jun. 1969 88 p refs In FRENCH; ENGLISH summary

(Contract EURATOM-001-64-ITRUB)

(EUR-4004.f; EURAEC-2072) Avail: CFSTI

Irradiation tests in the BR-3/PWR reactor have made it possible to assess a new fuel production method, developed by the Joint CEN-BelgoNucléaire Plutonium Group, which involves the introduction of plutonium in the fine fraction of the powders only. From the theoretical point of view, the irradiation tests have led to the successful completion of an important stage in the application to plutonium fuels of the calculation codes which were available when the experiment was carried out, and thus provide a first pointer in the study of the recycling of plutonium elements in water-cooled reactors. From the fabrication point of view, the large number of inspections carried out at various stages led to considerable improvements in the shaping of the fuel rods, both as regards the determination of the fabrication parameters and the decontamination of the finished rods or the study of the importance of hot spots. Author

N69-34936# Brown Boveri/Krupp Reaktorbau G.m.b.H., Mannheim (West Germany).
DYN: A DYNAMIC PROGRAM FOR PEBBLE-BED REACTORS [DYN: EIN DYNAMIKPROGRAMM FUR KUGELHAUFENREAKTOREN]
K. Friedrich, E. Infuhr, and L. Massimo 1969 61 p refs In GERMAN; ENGLISH summary
(EUR-4278.d; THTR-80) Avail: CFSTI

The DYN zero-dimensional programme (FORTRAN 4 for IBM 360/40) described was developed for the calculation of the dynamic behaviour of reactors with spherical fuel elements. Since pebble-bed reactors may contain fuel elements giving widely differing burn-ups, and in addition may even contain different types of fuel elements, the progamme was compiled in such a way that the calculation can be performed with up to 20 different types of element. Consequently, the temperature feed-back to the reactivity and also the maximum fuel-element temperatures can be correctly determined within the framework of the zero-dimensional model. Besides the calculation of processes in which the reactivity, the cooling-gas throughput or the gas inlet temperature is given as a function of time the simulation of control processes is also possible. Both short- and long-term processes can be studied. Author

N69-34937# European Atomic Energy Community, Karlsruhe (West Germany). Joint Nuclear Research Center.
CHEMICAL ANALYSIS OF PLUTONIUM BEARING NON-IRRADIATED FUELS AND THEIR COMPONENTS
M. J. Maurice, L. M. Angeletti, and K. Buijs 1969 67 p refs
(EUR-4133.e) Avail: CFSTI

A scheme for the analysis of plutonium containing nuclear fuels and their components is presented, and detailed procedures are given. Author

N69-34961# Atomic Energy Establishment, Winfrith (England). Reactor Development Div.
AN INVESTIGATION INTO THE EFFECTS OF A COSINE AXIAL HEAT FLUX DISTRIBUTION ON BURNOUT IN A 12 FT LONG ANNULUS USING FREON-12
G. F. Stevens, R. W. Wood, and J. Pryzbylski Sep. 1968 28 p refs
(AEEW-R-609) Avail: CFSTI; HMSO 4s 6d

A semi-empirical scaling technique was developed with the object of enabling an experiment in Freon-12 at relatively low pressures to be used to predict the burnout characteristics of a boiling water channel at pressures up to 1000 psia. Burnout results are given for an annular test section 12 ft long and having an inner heated rod 0.625 in. diameter, and an outer unheated tube of 0.825 in. bore. In one case the rod was uniformly heated and in the other case the rod was given a symmetrical chopped cosine heat flux profile. The Freon data are shown to compare well with equivalent water data using the established scaling technique; this applied both to burnout power and to burnout position. The comparison was made at pressures of 1000 psia and 750 psia water equivalent and the same scaling factors are shown to work at both pressures. Author (NSA)

N69-34987# Nuklear-Chemie Und -Metallurgie, G.m.b.H., Wolfgang Bei Hanau (West Germany).
TECHNOLOGICAL IMPROVEMENT IN THE FABRICATION OF CAST URANIUM CARBIDE RODS Final Report [VERBESSERUNG DER TECHNOLOGIE BEI DER FABRIKATION GEGOSSENER URANKARBID-STABE]
P. Himmelstein, H. Kuhn, O. Pfahls, and R. Lucas (EURATOM) Jun. 1969 40 p refs in GERMAN; ENGLISH summary
(Contract EURATOM-246-66-1 ORGD)
(EUR-4273.D) Avail: CFSTI

The aim was to develop a process for the economic fabrication of the nuclear fuel uranium monocarbide for the type of reactor developed in the Orgel Project. Work began with studies on the fabrication of uranium carbide from uranium dioxide and graphite powder. At the same time preliminary smelting tests were performed with small arc furnaces. The most favorable powders for the solid-state reaction together with the optimum conditions for the reaction were determined. Comprehensive studies were initiated on the influence of smelting conditions on the quality of uranium carbide rods. In arc smelting it was found that despite certain technical difficulties vacuum smelting was more suitable than shielding-gas smelting for the preparation of uranium carbide on a relatively large scale with a very low impurity fraction. Since the Orgel design requires uranium carbide rods to be fabricated with a well-defined surface area, all-round grinding of the rods is necessary. An account is given of the techniques used in cylindrical, cut-off, face and dishing grinding. The factors influencing the profitability of the process are discussed. Author

N69-35012# United Kingdom Atomic Energy Authority, Harwell (England).
REACTOR WATER PROBE
Vladimir Zajic Mar. 1967 10 p refs Transl. into ENGLISH from Jaderna Energie (Czechoslovakia), no. 13, 1967 p 1–3
(NP-tr-1755) Avail: AEC Depository Libraries

The construction and operation of a water filled probe for investigations of the radiation resistance of corrosion inhibitors are described. Use of the probe in static experiments on water corrosion of steel and corrosion inhibition in the radiation field of a VVR-S reactor is discussed. NSA

N69-35048# United Kingdom Atomic Energy Authority, Harwell (England). Materials Physcis Div.
MECHANICAL X-RAY SAFETY SHUTTERS FOR USE ON PHILLIPS PW 1008 AND 1016 TUBESHIELDS
C. F. Sampson and W. B. Brenner Jan. 1969 13 p refs
(AERE-R-5997) Avail: CFSTI; UK 3s 0d

It is pointed out that crystallographic instruments used with proprietary x-ray generators which do not have safety coupling attachments present many difficulties in laboratory supervision. With this in mind safety shutters were designed for the above tubeshields; these shutters are described and illustrated and their principle of operation given. Author (NSA)

N69-35049# General Electric Co., Schenectady, N.Y. Knolls Atomic Power Lab.
A TWO-DIMENSIONAL TRANSPORT THEORY PROGRAM IN A MODULAR SYSTEM ENVIRONMENT
Jack P. Friedman and Bruce W. Crawford 1969 9 p refs
(Contract W-31-109-eng-52)
(KAPL-P-3473; PB-183107) Avail: CFSTI CSCL 18K

IT is a general purpose two-dimensional, multigroup, multiregion, reactor physics code capable of solving several approximations of the neutron transport equation. A modular system environment for IT's development has contributed greatly to the incorporation of a large variety of approximations for rectangular, hexagonal, and azimuthally-symmetric geometrical configurations in both the energy and spatial domain. Complementary to its use for obtaining accurate transport theory scalar flux solutions, IT is a

research tool for examining the accuracy of various approximations of the transport equations. Author (USGRDR)

N69-35077# United Kingdom Atomic Energy Authority, Harwell (England). Materials Physics Div.
A TIME-OF-FLIGHT SPECTROMETER FOR COLD NEUTRON STUDIES ON THE DIDO 6H HOLE
G. C. Stirling Jan. 1969 19 p refs
(AERE-R-6035) Avail: CFSTI; UK 3s 6d

Details are given of the design and performance of a spectrometer planned for use with a pulsed beam of monochromatic neutrons of wavelengths 4 to 6Å, scattered into banks of counters at five of six different angles. Application was intended for the DIDO reactor 6 inch diameter horizontal radial hole, as an interior measure pending the construction of a permanent new design instrument. The spectrometer has been used in connection with the neutron scattering programme, and has been in continuous operation since June 1968. Author (NSA)

N69-35081# Brookhaven National Lab., Upton, N.Y.
CONTROLLED REMOVAL OF SPHERES FROM A GEOMETRICALLY ORDERED PACKED BED BY SURFACE FLUIDIZATION
Herbert Susskind, Robert Odette, and Walter Becker [1967] 30 p refs Presented at the 61st Ann. Amer. Inst. of Chem. Eng. Conf., Los Angeles Sponsored by AEC
(BNL-12625; CONF-681212-2) Avail: CFSTI

The removal of individual layers of balls from the surface of an ordered packed bed without disturbing the remaining packing was investigated. The modified jet pumping procedure could be used in the countercurrent fuel movement in the Ordered Bed Fast Reactor, as well as for the selective unpacking of beds of spheres in other industrial applications. Liquid jets entering two opposite sides of a square cross-section column through rectangular nozzles above the surface of the packed bed produced drag forces on the balls at a critical flow rate that were strong enough to entrain them and carry them out with the outgoing liquid. The distance of bed penetration increased with this critical flow rate. Such variables as liquid flow, ball density and diameter, nozzle velocity and inclination, and column size were investigated, and a mechanism for this model was postulated. Author (NSA)

N69-35082# Massachusetts Inst. of Tech. Cambridge. Dept. of Nuclear Engineering.
RESEARCH AND EDUCATIONAL ACTIVITIES AT THE MIT RESEARCH REACTOR, FISCAL YEAR 1968
Dec. 1968 143 p refs
(Contract AT(30-1)-1967)
(MIT-1967-2; MITNE-98) Avail: CFSTI

The research and educational activities which utilized the Massachusetts Institute of Technology, five-megawatt, heavy water, research reactor during fiscal year 1968 are described. Research projects at MIT which make significant use of the MITR are described, and principal participating personnel are named. Listings are provided of theses, reports, journal articles, and conference papers resulting from these projects during fiscal year 1968. In addition to the educational value derived from the many research activities by the students who participated in them, training in several areas of nuclear technology is imparted through formal courses designed to make use of the reactor or its research projects. The courses are briefly described, and attendance figures are given. The reactor, its purpose, its organization, and a summary of operations are briefly described in order to provide a more complete understanding of the MITR program. 32 references. Author (NSA)

N69-35084# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
ESTIMATED READOUT ERRORS PRODUCED BY RADIATION AND TEMPERATURE EFFECTS IN COAXIAL SIGNAL CABLES FOR FFTF
J. L. Stringer and R. R. Bourassa Apr. 1969 28 p refs
(Contract AT(45-1)-1830)
(BNWL-1026) Avail: CFSTI

The problem of nuclear radiation generated currents in signal cables exposed to a radiation field and the change in insulator conductivity caused by radiation have been known and recognized for many years. After an analytical model was developed to explain how these currents are generated, experiments were performed in a pulsed TRIGA reactor to evaluate the radiation-induced currents and the induced-conductivity effects on MgO insulated stainless steel coaxial cables. These data are used to estimate expected readout error from dc sensors located in an environment approximating an FFTF-LMFBR core. Results of these evaluations for stainless steel coaxial cables insulated with MgO indicate that the readout error, due to a radiation field of 5×10^9 R/hr and 1200°F, will be equal to: (% error) = $|IR_s/V| \times 100$, where I = total radiation-induced current, V = sensor output voltage, and R_s = sensor source impedance. Author (NSA)

N69-35216# General Electric Co., Schenectady, N.Y. Knolls Atomic Power Lab.
APPLICATION OF MONTE CARLO METHODS IN REACTOR PHYSICS
M. R. Mendelson *In* Am. Nucl. Soc. Resonance Cross Sect. in the Unresolved Resonance Reg. and Appl. of Monte Carlo Tech. to Reactor Phys. 13 Sep. 1968 23 p (See N69-35209 20-24)
(Contract W-31-109-eng-52)
(CONF-680601-51) Avail: CFSTI

A description of the Monte Carlo computer codes used for reactor physics calculations is given. The uses of Monte Carlo methods as analytical tools and for simulation of idealized experiments are discussed. Development of the two-dimensional multigroup theory code IT is used to illustrate code development: methods for assessing accuracy of codes are summarized. Capabilities of the DRAM and MORSE codes are compared; comparisons of DRAM-simulated data and experimental data are tabulated. NSA

N69-35217# Atomics International, Canoga, Calif.
APPLICATIONS OF MONTE CARLO TO PROBLEMS IN REACTOR DESIGN AND EXPERIMENTAL ANALYSIS
Leo B. Levitt *In* Am. Nucl. Soc. Resonance Cross Sect. in the Unresolved Resonance Reg. and Appl. of Monte Carlo Tech. to Reactor Phys. 13 Sep. 1968 12 p refs (See N69-35209 20-24)
(CONF-680601-50) Avail: CFSTI

Application of the Monte Carlo method to fuel cell configurations for the HWOCR is discussed. Relative power calculations are shown for various types of HWOCR fuel element bundles. Core neutronics parameters calculated by the HWOCR-SAFE program are tabulated for actual and HAMMER geometries. Application of the backward random walk principle to reaction rate determination is discussed. Adjoint mode sampling techniques are described; difficulties in adjoint Monte Carlo sampling arising from reversal of kernel arguments are detailed. The use of a biased adjoint scattering kernel is described; equations for weight factors for adjoint Monte Carlo applications are given. NSA

N69-35218# United Nuclear Corp., Elmsford, N.Y. Research and Engineering Center.
DEVELOPMENT AND USE OF MONTE CARLO TECHNIQUES IN REACTOR DESIGN AT UNITED NUCLEAR CORPORATION

F. R. Nakache *In* Am. Nucl. Soc. Resonance Cross Sect. in the Unresolved Resonance Reg. and Appl. of Monte Carlo Tech. to Reactor Phys. 13 Sep. 1968 21 p refs (See N69-35209 20-24) (CONF-680601-53) Avail: CFSTI

Use of Monte Carlo programs for evaluation of neutronics characteristics of boiling and pressure water reactor fuel assemblies is discussed. Programs used to prepare or process neutron cross section input data are listed; each is described briefly. A general description of reactivity Monte Carlo programs is given; a PILE flow diagram is included. Application of the computer programs to fuel assemblies for boiling and pressurized reactors is discussed. Comparison of measured neutron multiplication factor values and THERMOPILE-PILE data are tabulated; measurements were made on boiling water reactor fuel assemblies in the Pawling Lattice Test Rig. Design parameters for the fuel assemblies are given. Errors between measured and calculated values are analysed. Solution of diffusion problems by Monte Carlo methods is discussed; a two-dimensional floating random walk method is described. NSA

N69-35219# European Atomic Energy Community, Ispra (Italy). Research Center.

THE APPLICATION OF MONTE CARLO TO NEUTRON TRANSPORT AND REACTOR ANALYSIS PROBLEMS AT THE EURATOM RESEARCH CENTER ISPRA

H. Rief *In* Am. Nucl. Soc. Resonance Cross Sect. in the Unresolved Resonance Reg. and Appl. of Monte Carlo Tech. to Reactor Phys. 13 Sep. 1968 19 p refs (See N69-35209 20-24) (EUR/C-IS/984/68-e; IP/0058/R; CONF-680601-54) Avail: CFSTI

The TIMOC code for Monte Carlo fast reactor physics calculations is described. Three relatively unique features of the TIMOC code are: calculation of small reactivity effects in a complicated three dimensional geometry, sampling of time eigenvalues, and effective variance technique for treating time dependent neutron migration in small systems; each of these is discussed. Reactivity and neutron generation times, calculated by TIMOC, are tabulated for SORA; the model used for the calculations is described; time eigenvalues are tabulated. Application of the TIMOC code to time dependent neutron migration studies is discussed. NSA

N69-35220# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.

THE NUMERICAL CALCULATION OF THE STEAM CYCLE OF NUCLEAR POWER STATIONS [DIE NUMERISCHE BERECHNUNG DER DAMPFKREISLAEUFE VON KERNKRAFTWERKEN]

H. G. Franze Aug. 1968 137 p refs In GERMAN (KFK-816) Avail: AEC Depository Libraries

Optimization criteria for nuclear power plant design and performance are given. Computer calculations of water and steam entropies are discussed in detail. The Clausius – Rankine steam cycle with preheating is described; advantages and economics of the preheat cycle are evaluated. The interdependence of circuit design and thermodynamic calculations for the reactor installation is analyzed. Data tabulations and detailed analyses are included. Author (NSA)

N69-35227# American Nuclear Society, Cincinnati, Ohio. Southwestern Ohio Section.

FAST REACTOR SYSTEMS, MATERIALS AND COMPONENTS National Topical Meeting Proceedings

W. E. Niemuth ed. and J. F. Weissenberg ed. Oak Ridge, Tenn. AEC [1969] 438 p refs Conf. held in Cincinnati, 2-4 Apr. 1968 (CONF-680419) Avail: CFSTI

In five sessions, the applications, the system requirements, the structural materials, the components, and related problem areas involving fast nuclear reactors were presented with free discussions following. Responses to the papers are included in this document. The research, development, and design aspects are emphasized; numerous engineering drawings, performance test comparisons, and flow charts are integrated in the presentations. M.H.E.

N69-35228# Atomic Energy Commission, Washington, D.C.

FAST REACTOR SYSTEMS FOR SPACE POWER

Carl E. Johnson *In* Am. Nucl. Soc. Fast Reactor Systems, Mater. and Components [1969] p 41 – 60 refs (See N69-35227 20-22)
Avail: CFSTI

Tens-of-kilowatts of electric power will be needed in space in the 1970's and hundreds-of-kilowatts in the 1980's. The reactor space power development program, to meet these needs, emphasizes three reactor concepts: the ZrH thermal reactor for use with thermoelectric or dynamic conversion for the ten-of-kilowatts range in the 1970's, and the thermionic and advanced liquid metal cooled reactors for use with a variety of power conversion systems by 1980. The development objectives of the space power reactor program are discussed, and an irradiation capsule and a liquid metal corrosion capsule which might be useful in other fast reactor projects are described. Author (NSA)

N69-35229# Gulf General Atomic, San Diego, Calif.

FACTORS AFFECTING THE DESIGN OF GAS-COOLED FAST BREEDER REACTORS

G. Melese-d'Hospital *In* Am. Nucl. Soc. Fast Reactor Systems, Mater. and Components [1969] p 63 – 88 refs (See N69-35227 20-22)
Avail: CFSTI

Gas-cooled fast breeder reactors are characterized by a great design flexibility because of the decoupling of gas temperature and pressure, the small coolant nuclear interaction, and the lack of chemical and neutron activation of He. Performance, such as 10 years doubling time or 40% thermal efficiency, comparable to those of high-grain oxide-fueled LMFBR, are obtainable with GCFR at modest pressures (70 to 100 atm) and pressure drops ($\Delta p/p \sim$ 5%) for maximum clad temperatures of 650° to 700°C. Besides the advantage of easier gas technology compared to Na, GCFR can benefit from better fuels such as carbides and from the simpler direct gas turbine cycle. Author (NSA)

N69-35231# Battelle-Northwest, Richland, Wash.

CERAMIC FUELS FOR FAST REACTORS

Stanley Goldsmith, R. J. Jackson, and E. T. Weber *In* Am. Nucl. Soc. Fast Reactor Systems, Mater. and Components [1969] p 185 – 188 refs Previously announced as BNWL-SA-1550; see N68-30785 18-22 (See N68-35227 20-22)
(BNWL-SA-1550) Avail: CFSTI

Fast reactor fuels are subjected to considerably more severe operating conditions than are thermal reactor fuels. Differences in service conditions and design parameters for fast reactor and thermal reactor fuels are described. Currently, three uranium-plutonium ceramic compounds - oxides, carbides, and nitrides - all have high potential as fast reactor fuels. The relative merits of these compounds are assessed by comparing their thermal properties, swelling behavior, and compatibility characteristics. The design factor affecting performance of fast reactor ceramic fuels are identified. Author

N69-35232# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
IRRADIATION BEHAVIOR OF CLADDING AND STRUCTURAL MATERIALS
J. R. Weir, J. O. Stiegler, and E. E. Bloom *In* Am. Nucl. Soc. Fast Reactor Systems, Mater. and Components [1969] p 189–224 refs (See N69-35227 20-22)
(ORNL-TM-2258) Avail: CFSTI

The effects if irradiation on the mechanical and physical properties of materials to be used as cladding and structural components in fast reactors are of great interest to the reactor designer. The general aspects of the problem are discussed in terms of the observed changes in properties and microstructure and the possible mechanisms that might explain the observed effects. The discussion is concerned primarily with the austenitic stainless steels and with changes in mechanical properties which occur at test temperatures near the irradiation temperatures. In the low-temperature range there is an increase in yield strength and reduction of work-hardening coefficient and uniform strain. At intermediate temperatures irradiation produced changes in the precipitation process become important. In this same temperature range the formation of voids and dislocation loops after irradiation to high fast neutron fluences causes large increases in yield strength and large reductions in ductility paramaters. At high-irradiation temperatures strength properties are not affected; however, ductility is severely reduced. Author (NSA)

N69-35234# United Nuclear Corp., Elmsford, N.Y.
LIQUID SODIUM AS A REACTOR COOLANT
Kurt Goldmann *In* Am. Nucl. Soc. Fast Reactor Systems, Mater. and Components [1969] p 244–272 refs (See N69-35227 20-22)
Avail: CFSTI

The attainment of high breeding ratios, leading to low fuel cycle costs and conservation of our natural uranium resources, is shown to be the primary reason for selecting Na as a reactor coolant. Reliability of Na systems is discussed. Failures in existing systems, which operate at Na temperatures below 1000°F, are attributed generally to poor engineering practices rather than to a lack in Na materials technology. If further reductions in power costs are to be realized by raising Na temperatures to 1200°F to 1400°F to generate 1050°F steam, the state-of-the-art of Na technology must be extended in the areas of fuel cladding and steam generator materials and Na purity control. Author (NSA)

N69-35235# Battelle-Northwest, Richland, Wash.
FFTF FUEL DEVELOPMENT PROGRAM
C. A. Burgess, J. E. Hanson, and B. R. Hayward *In* Am. Nucl. Soc. Fast Reactor Systems, Mater. and Components [1969] p 273–290 Previously announced as BNWL-SA-1750; see N69-30722 18-22 (See N69-35227 20-22)
(BNWL-SA-1750) Avail: CFSTI

The FFTF driver fuel development program is directed toward high functional reliability and safety of the initial core through the use of conventional fuel element materials and fuel component design. This paper describes the two primary phases of the development program; process development and irradiation testing. These activities are integrated with the LMFBR program. The principal irradiation tests consist of encapsulated full length pins in GETR, prototypic bare pin assemblies in EBR-II, and transient tests in TREAT. The candidate and alternate fuel fabrication routes are discussed. The reference mixed oxide pellet fabrication method is mechanical blending, cold pressing, and sintering solid cylindrical pellets. Large scale fabrication demonstration rounds by industry are planned. The results from this program will provide extensive basic knowledge and fuel performance data for the rapidly developing fast reactor era. Author

N69-35236# Aktiebolaget Atomenergi, Stockholm (Sweden).
FUEL ELEMENT DESIGN AND CLADDING MATERIAL DEVELOPMENT FOR HIGH PRESSURE COOLANT FAST BREEDER REACTORS
Lars Unneberg *In* Am. Nucl. Soc. Fast Reactor Systems, Mater. and Components [1969] p 291–300 refs (See N69-35227 20-22)
Avail: CFSTI

The Swedish fast reactor program has so far been limited to comparative studies of different coolants. Problems of critical nature have been investigated in some detail. Calculations of creep collapse of canning tubes have been performed with a method that permits relaxation and thermal stresses to be considered. Criteria such as creep due to internal overpressure at end-of-life conditions and short time failure due to core depressurization or shut-down have also been investigated. Fuel viscosity is believed to be very important in connection with swelling and an irradiation experiment to investigate this is presented. A new series of canning materials for fast reactors is described. Author (NSA)

N69-35237# General Electric Co., Sunnyvale, Calif. Advanced Products Operation.
COMPONENTS FOR STEAM COOLED REACTORS: REQUIREMENTS AND DEVELOPMENT STATUS
F. J. Leitz, G. J. Rittenmyer, and H. J. Schneider *In* Am. Nucl. Soc. Fast Reactor Systems, Mater. and Components [1969] p 303–325 refs (See N69-35227 20-22)
Avail: CFSTI

A description of the steam cycle for a steam-cooled fast reactor is presented. A diagram and design parameters for a 50 MW(e) Loeffler cycle power conversion system are presented. NSA

N69-35238# Argonne National Lab., Ill.
COMPONENTS FOR MAIN HEAT-TRANSPORT SYSTEMS FOR SODIUM-COOLED FAST BREEDER REACTORS
W. R. Simmons *In* Am. Nucl. Soc. Fast Reactor Systems, Mater. and Components [1969] p 326–353 refs (See N69-35227 20-22)
Avail: CFSTI

The operation and development programs of EBR-II, Enrico Fermi, SRE, and Hallam provide the bulk of U.S. experience with components for main heat-transport systems–specifically, pumps, intermediate heat exchangers, and some elements of piping systems. Some 50,000 hours of reactor operation and a few hundred thousand hours of experience with main heat-transport system components have been accumulated by these four plants. Components for SRE alone have logged 44,000 hours of Na service with over half above 500°F and some 1000 hours above 900°F. EBR-II secondary-system components and Enrico Fermi primary-system components have logged separately more than 23,000 hours. Operation performances for these components are described. Author (NSA)

N69-35239# Atomic Power Development Associates, Inc., Detroit, Mich.
SODIUM HEATED STEAM GENERATORS
E. C. Kovacic, J. S. Mc Donald (Atomics Intern.), and P. J. Probert (Babcock and Wilcox) *In* Am. Nucl. Soc. Fast Reactor Systems, Mater. and Components [1969] p 354–402 refs (See N69-35227 20-22)
Avail: CFSTI

A report of the available information on the development of sodium heated steam generators in the U.S. is presented. Topics discussed include: repairs to the Enrico Fermi Atomic Power Plant steam generators; design and development of the Atomics

International modular steam generator; construction of the Babcock & Wilcox prototype unit; results of the large-leak sodium water reaction tests at Atomics International; and the small-leak sodium water reaction tests at Atomic Power Development Associates, Inc.
Author (NSA)

N69-35240# Combustion Engineering, Windsor, Conn.
REVIEW OF FBR CORE DESIGN PROBLEM AREAS
R. C. Noyes *In* Am. Nucl. Soc. Fast Reactor Systems, Mater. and Components [1969] p 437–444 refs (See N69-35227 20-22)
Avail: CFSTI

The FBR core design procedures are described. Topics discussed include: fuel cycle costs; flow characteristics in core; and heat transfer.
NSA

N69-35241# Brookhaven National Lab., Upton, N.Y.
SOME MATERIALS PROBLEMS IN FAST REACTORS
David H. Gurinsky *In* Am. Nucl. Soc. Fast Reactor Systems, Mater. and Components [1969] p 445–448 ref (See N69-35227 20-22)
Avail: CFSTI

Problems concerned with the design and development of Na- and NaK-cooled fast reactors are briefly described.
NSA

N69-35242# Battelle-Northwest, Richland, Wash.
IRRADIATION TESTING FACILITIES: NEEDS, LIMITATIONS AND AVAILABILITY
S. O. Arneson *In* Am. Nucl. Soc. Fast Reactor Systems, Mater. and Components [1969] p 449–453 Previously announced as BNWL-SA-1754; see N68-87229 17-99 (See N69-35227 20-22)
(Contract AT(45-1)-1830)
(BNWL-SA-1754) Avail: CFSTI

The needs for fast reactor irradiation testing facilities are reviewed and the availability of testing reactors to meet the needs are discussed. Limitations of available facilities are identified and space requirements are compared with availability. The need for continued and improved availability of EBR-II for near term fast reactor fuels and materials testing is emphasized and alternate testing facilities such as Fermi are briefly reviewed. The overall testing capabilities of the Fast Flux Test Facility are discussed.
Author (NSA)

N69-35243# Commonwealth Edison Co., Chicago, Ill.
UTILITY REQUIREMENTS IN FAST BREEDERS
C. B. Zitek *In* Am. Nucl. Soc. Fast Reactor Systems Mater. and Components [1969] p 454–458 (See N69-35227 20-22)
Avail: CFSTI

The economic requirements for the development of fast breeder power reactors are analyzed as seen by the utility company.
NSA

N69-35261# Los Alamos Scientific Lab., N.Mex.
DISPOSABLE CORE FAST BURST REACTORS
L. D. P. King [1968] 19 p refs Presented at the Fast Burst Reactor Natl. Topical Meeting, Albuquerque, N.Mex.
(Contract W-7405-eng-36)
(LA-DC-10055; CONF-690102-5) Avail: CFSTI

A possible means for producing very large fast neutron bursts appears feasible through the use of a mobile fuel in an undefined geometry. The fuel is dispersed by internal energy into a large cavity for reuse without damage to the main facility. A study of such a potential system has been made using a design concept designated Liquid Excursion Pulsed Reactor (LEPR). Calculations and preliminary experiments for such a system when using uranyl sulfate fuel solution are analyzed. Burst intensities of 10^{19} to 10^{20} may be possible with minimum pulse widths at half maximum of 35 μsec. Two schematic designs are illustrated.
Author (NSA)

N69-35275# Los Alamos Scientific Lab., N.Mex.
NEUTRON BLANKET CALCULATIONS FOR THERMONUCLEAR REACTORS, PART 2
George I. Bell 11 Mar. 1969 8 p refs
(Contract W-7405-eng-36)
(LA-4131) Avail: CFSTI

The breeding potentials of various neutron blankets surrounding a pulsed thermonuclear reactor were calculated using multigroup methods. A basic lithium blanket containing up to 15 vol. % niobium was found to give marginal breeding. For such Nb concentrations the neutron flux depression at Nb resonances should be taken into account in devising multigroup cross sections; this resonance self-shielding increases the triton production by 10% in the basic blanket. Several modifications of the basic design were found to give improved breeding, in which the ratio of tritons produced to tritons burned, in producing 14-MeV neutrons, is equal to or greater than 1.20. These include (a) replacement of Nb by Mo and Zr, (b) use of lithium enriched in ^{6}Li, and (c) addition of hydrogen to the blanket. The displacement of lithium by beryllium does not appear attractive. Thus, a variety of options are available to obtain satisfactory breeding from a lithium blanket containing substantial amounts of structural material.
Author (NSA)

N69-35385# Minnesota Mining and Mfg. Co., St. Paul, Minn. Electrical Products Group
SNAP-23A PROGRAM, PHASE 1: THERMOELECTRIC CONVERTOR DEVELOPMENT PROGRAM Monthly Report, Feb. 1969
Feb. 1969 42 p refs
(Contract AT(30-1)-3824)
(MMM-3824-33) Avail: CFSTI

Design efforts were continued to finalize the design of the converter electrical interface for SNAP-23A. Inconel 625 is the preferred material for the converter outer case on the basis of its inherent resistance to corrosive attack in all anticipated SNAP-23A environmental conditions. The preferred material for the heat source, stud jacket, and converter hot frame is Type 304 stainless steel. Test data evaluation and analysis were performed on the following long term test devices: No. 2 (EMC-2), No. 3 (EMC-3), No. 1B (PMC-1B), 10-Couple Modules 1 and 3 and 5 through 12, 6-Couple Module 23A3, and converter 23P2. Structure and enclosure design activities for PMC-2 continued. The instrumentation requirements were established. With the change of enclosing structural materials to Type 304 stainless steel and Inconel 625, weld development plans were prepared.
NSA

N69-35362# Kyoto Univ. (Japan). Research Reactor Inst.
LOG OF INTERIOR RADIOACTIVITY MONITORING, PART 2
Yukinori Katsurayama, Fumikazu Hayashi, Teruie Sumino et al 1965 32 p refs In JAPANESE
(KURRI-TR-11) Avail: AEC Depository Libraries

A record of the radiation monitoring program for the Kyoto University Research Reactor for the year 1965 is presented. The measurements include determination of dose rates, cumulative doses, surface contamination concentrations, radioactivity of waste water, radioactive dust accumulations, and radioactive gas

concentrations. During 1965, the reactor was changed from experimental to steady state operation, resulting in an increased use of hot laboratories and monitoring areas. Data on surface contamination in the laboratories, activity of the waste water from the research buildings, radioactive dust released from the stack, and radioactive gas concentration revealed no unusual incidents. NSA

N69-35397# Commissariat à l'Energie Atomique, Chuscian (France). Centre de Production de Plutonium.

DECONTAMINATION BY FRACTIONAL DISTILLATION OF A RADIOACTIVE MIXTURE OF PERCHLORETHYLENE, BITUMEN AND SLUDGES FROM CHEMICAL COPRECIPITATIONS [DECONTAMINATION PAR DISTILLATION FRACTIONNEE D'UN MELANGE RADIOACTIF CONSTITUE PAR DU PERCHLORETHYLENE, DU BITUME ET DES BOUES DE COPRECIPITATION CHIMIQUE]

Guy Lefillatre and Raoul Hullo May 1969 25 p In FRENCH; ENGLISH summary
(CEA-R-3778) Avail: CFSTI

As it is not possible to incinerate the contaminated organic waste containing chlorine produced at the Marcoule Centre (France) the only valid method for these solvents of average activity is fractional distillation. The waste processing screw extrusion apparatus is used to coat the radioactive sludges with bitumen and the solvents are produced whilst decontaminating this plant with perchlorethylene. This report describes a pilot fractional distillation plant to deal with these solvents. The pilot plant operates discontinuously and is used to decontaminate the perchlorethylene, to separate the perchlorethylene from the water, and to process the distillation residue. The installation decontamination factor is 3.4×10^6 when solvents with a specific activity of 0.23 Ci/m^3 are used. The average flow-rate for a distillation run is 10 l/h at atmospheric pressure, and 21 l/h at a residual pressure of 40 torr. The decontamination factor for the installation is better at atmospheric pressure than in a vacuum. Author (ESRO)

N69-35511# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

DIVISION OF ISOTOPE DEVELOPMENT PROGRAMS Quarterly Report, Nov. 1968 - Jan. 1969

K. Drumheller (ed.) Feb. 1969 46 p refs
(Contract AT(45-1)-1830)
(BNWL-1010) Avail: CFSTI

Progress in the following isotope development programs is reported: a monitor-system for the development of protable acoustic emission testing; americium-241, californium-250 and -252 production rates in light water reactors; plutonium-236 content in plutonium-238 by computation; the preparation and properties of metallic promethium, and the effects of feed dilution on its purification; differential thermal analysis equipment developed for phase studies of promethium oxide, Knudsen cell vapor pressure equipment for measurement of promethium oxide properties, and a counting method for measuring promethium oxide dissolution rate in water; and the cost estimates for plutonium-238 production by irradiation of neptunium-237 in PWR. M.H.E.

N69-35548# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

A ONE-DIMENSIONAL DIFFUSION CODE FOR GENERATING EFFECTIVE NUCLEAR CROSS SECTIONS: 1DX

R. W. Hardie and W. W. Little, Jr. Mar. 1969 119 p refs
(Contract AT(45-1)-1830)
(BNWL-954) Avail: CFSTI

Code 1DX is a multipurpose, one-dimensional (plane, cylinder, sphere) diffusion theory code for use in fast reactor analysis. The code is designed to: compute k_{eff} and perform criticality searches on time absorption, reactor composition, reactor dimensions, and buckling by means of either a flux or an adjoint model; compute and punch collapsed microscopic and macroscopic cross sections averaged over the spectrum in any specified zone; and compute and punch resonance shielded cross sections using data in the Russian format. All programming is in FORTRAN-IV. Since variable dimensioning is employed, no simple restrictions on problem complexity can be stated. In a 65K memory, 100-group problems are feasible for a moderate number of mesh intervals (30). A representative 26-group k_{eff} calculation with 30 spatial intervals using data in the Russian format requires about 40 seconds on a UNIVAC 1108. Author (NSA)

N69-35562# Science Research Council, London (England) Rutherford High Energy Lab.

NIMROD OPERATION AND DEVELOPMENT Quarterly Report, 1 Jul. - 30 Sept. 1968

D. E. Gray, ed Dec. 1968 28 p ref
(RHEL/R-175) Avail: CFSTI; UK 4s 6d

Work reported includes the following: Details of operation of the nimrod accelerator; measurement of the effective spill time for slow spill targeting; measurement of RF structure on slow spill; and radiation dosimetry (inner vacuum vessel, plunging magnet, outer vacuum vessel, pressure bag, and extracted proton beam lines). The experimental program is also summarized. NSA

N69-35621# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.

PILOT PRODUCTION OF 325 kg OF URANIUM [FABRICATION PILOTE DE 325 kg DE CARBURE D'URANIUM]

Christian Clozet, Jacques Dessus, Jacques Devillard, Michel Guibert, and Guy Moriot Apr. 1969 45 p In FRENCH; ENGLISH summary
(CEA-R-3745) Avail: CFSTI

This report describes the pilot fabrication of uranium carbide rods to be mounted in bundles and assayed in two channels of the EL 4 reactor. The fabrication process includes: (a) elaboration of the uranium carbide granules by carbothermic reduction of uranium dioxide, (b) electron bombardment melting and continuous casting of the granules, (c) machining of the raw ingots into rods of the required dimensions. The rods will eventually be piled-up to make fuel elements. Both qualitative and quantitative results of this pilot production chain are presented and discussed. Author (ESRO)

N69-35667# United Kingdom Atomic Energy Authority, Risley (England).

SQUIFID: A SQUARE-MESH FEW-GROUP REACTOR DIFFUSION CODE

C. W. J. Mc Cellan 19 Sep. 1968 54 p refs
(TRG-Report-1781) Avail: CFSTI

SQUIFID is a FORTRAN 4 program that solves the few-group neutron diffusion equations. Using a square mesh, the program can solve the conventional or homogenised diffusion equations in which the properties of a fuel channel are smeared out over a mesh area. Alternatively, the source-sink equations appropriate to a graphite moderated reactor with cylindrical channels on a square lattice can be solved. Some features of SQUIFID which make it attractive as a means of solving the homogenised equations are the ability to treat whole-cores, half-cores, quadrants, or octants with either a channel position or an interstitial position coinciding with the

reactor core's center. For such calculations the flux may vanish on an outer boundary that may be either circular or polygonal in shape. NSA

N69-35663# Kernforschungszentrum, Karlsruhe (West Germany). Institut für Reaktorbauelemente.
TEMPERATURE AND STRESS DISTRIBUTIONS IN FUEL ROD CLADDINGS WITH SPIRAL SPACERS FOR STEAM-COOLED FAST BREEDER REACTORS
H. Hoffmann and K. Rust Jun. 1968 77 p refs In GERMAN
(KFK-805; EUR-3965) Avail: AEC Depository Libraries

The temperature fields and stresses in clad rods with spiral spacers are influenced by the geometry of the spacers, the local heat transfer conditions, and the operating conditions. The number of ribs is important for determination of the maximum temperature. Six ribs per tube give insignificantly smaller comparative stresses than 3 ribs. The thermal conductivity of the material has little influence on the temperature profile. Smooth ribbed tubes with slanting sides gave essentially identical temperature distributions in the walls as those with even sides or rough surfaces and at the same time smaller stresses to the rib top. Calculations for transient operating conditions gave a very strong temperature increase in the first 5 seconds after beginning and the fuel rod cladding burden reached a maximum during this short time span. Results are given in tables and graphs. NSA

N69-35671# Kernforschungszentrum, Karlsruhe (West Germany).
ON THE DEVELOPMENT OF FAST BREEDERS
W. Haefele Nov. 1968 47 p refs Presented at Intern. Conf. on the Constructive Uses of At. Energy, Washington, D.C., 10–15 Nov. 1968
(KFK-881; Conf-681101-30) Avail: AEC Depository Libraries

The status of fast breeder reactor research and development is reviewed, and specific aspects of fast reactor physics, fuel element performance, safety, and coolant technology are discussed. First generation fast breeder reactors and critical assemblies are tabulated, and the results of some physics and materials investigations are presented. Author (NSA)

N69-35678# Tennessee Univ., Knoxville.
APPROXIMATE SOLUTION OF THE XENON-TRANSIENT PROBLEM BY A MODAL EXPANSION TECHNIQUE
John Woods Stewart, II (Ph.D. Thesis) Mar. 1969 125 p refs Sponsored by AEC
(TID-25062) Avail: CFSTI

Nuclear power reactors now being designed for construction in the United States are capable of sustaining spatial power oscillations due to the presence of Xe and I_2 as fission products. A mathematical and physical description of these reactors is presented. Pertinent previous methods of solution to the Xe-transient problem are presented. An extensive list of references is included. A numerically practical method of solution to the Xe transient problem is presented. This method uses a modal expansion of the multienergy group neutron fluxes in multi-dimensions. The model is capable of treating nonlinear feedback and spatially dependent control action. A variational principle is applied to obtain matrix equations for the modal coefficients. The results of a numerical demonstration are included. This demonstration utilizes the quasi-static flux approximation in one- and two-dimensional, rectangular geometry, with two neutron energy groups. Author (NSA)

N69-35694# Princeton Univ., N.J.
NUCLEAR PHYSICS Progress Report, Apr. 1968 Apr. 1969
Apr. 1969 43 p
(Contract AT(30-1)-937)
(PUC-937-359) Avail: CFSTI

The development and operation of the Princeton isochronous cyclotron and the accompanying experimental facilities in the period April 1968 to April 1969 is described. Research on nuclear reactions nuclear theory, and atomic beam studies is also reported. NSA

N69-35696# Batelle-Northwest, Richland, Wash. Pacific Northwest Lab.
A NUMERICAL COMPARISON OF DIFFUSION AND TRANSPORT (S SUB n) CODES FOR SELECTED FAST REACTOR CONFIGURATIONS
L. D. O'Dell, R. W. Hardie, and W. W. Little, Jr. Mar. 1969 31 p refs
(Contract AT(45-1)-1830)
(BNWL-992) Avail: CFSTI

Numerical comparisons between the one-dimensional diffusion code, 1DX, and the one-dimensional transport code, DTF-IV, are described. The objective of the comparison is to determine under what circumstances diffusion codes are sufficiently accurate to be used in place of transport codes. For large breeder reactors, it is found that diffusion theory is adequate to compute virtually all preliminary design parameters, including control rod worths and neutron fluxes far from the core. Author (NSA)

N69-35700# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
REVISED FAST REACTOR LIBRARY FOR USE WITH RIBD
L. D. O'Dell and W. L. Bunch Apr. 1969 28 p refs
(Contract AT(45-1)-1830)
(BNWL-962) Avail: CFSTI

A revised nuclear data library has been generated for use with RIBD to calculate fission product inventories and decay heat rates associated with fuels irradiated in fast reactor environments. Nuclear data include fission yield from both ^{239}Pu and ^{238}U, half life, capture cross section, and decay energies for each of 450 isotopes and isomeric states that can be produced as a result of fission. Recent literature was reviewed to obtain available experimental data. Theoretical values were employed as necessary to complete the library. Author (NSA)

N69-35723*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE POTENTIAL OF NUCLEAR POWER FOR HIGH-SPEED OCEAN-GOING AIR-CUSHION VEHICLES
Frank E. Rom and Albert F. Kascak Washington Sep. 1969 34 p refs
(NASA-TM-X-1871) Avail: CFSTI CSCL 21F

The use of nuclear powerplants based on nuclear aircraft technology to power ocean-going air-cushion vehicles has been investigated. Because aircraft nuclear powerplants might be an order of magnitude lighter than current nuclear marine plants, the performance of nuclear air-cushion vehicles is dramatically altered. Instead of vehicles limited to short ranges and speeds of about 80 knots, they become vehicles with virtually unlimited range and speeds in the range of 100 to 200 knots. The study considers vehicles with gross weights of 1000 to 10,000 tons and clearance heights from 10 to 40 feet, which are sufficient to clear ocean waves 80 to over 90 percent of the time. The cargo capacity ranges from 20 to 50 percent of the gross weight. Direct operating costs are 2 to 5 cents per ton-mile and are independent of the distance travelled. Author

N69-35761# Oak Ridge National Lab., Tenn.
DESIGN CONSIDERATIONS OF REACTOR CONTAINMENT SPRAY SYSTEMS, PART 1
T. H. Row, L. F. Parsly, and H. E. Zittel Apr. 1969 30 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-2412) Avail: CFSTI

Pressurized water reactors currently being designed include a containment building spray system for pressure reduction following a design basis accident. An additional function proposed for these spray systems is the removal of fission products, particularly iodine, released to the containment building during such an accident. A number of design considerations associated with this fission product removal in light of the information developed in the Spray and Absorption Technology Program are analyzed. Questions relating to the removal process and the radiation and thermal stability of the solutions are examined. Author (NSA)

N69-35807# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Atomnoi Energii
THEORY OF THE CRITICALITY OF A REACTOR DURING OSCILLATIONS OF THE FUEL DENSITY [TEORIYA KRITICHNOSTI REAKTORA PRI KOLEBANIYAKH PLOTNOSTI GORYUCHEGO]
V. M. Novikov 1968 17 p refs In RUSSIAN; ENGLISH summary
(IAE-1641) Avail: AEC Depository Libraries

Uniform distribution of the fuel does not represent the optimum loading of a reactor; the critical mass reaches a minimum when the fuel is more strongly concentrated in the central portion of the core. A just-critical reactor with uniformly distributed fuel becomes supercritical if the fuel is shifted toward the center; a gaseous fuel may thus be affected by acoustical oscillations. Thus, the dynamic behavior of the reactor may be controlled by exciting acoustical oscillations in the fuel channels containing a gaseous fuel; the oscillations must be in the same phase in all channels. This requires a simultaneous solution of the gas hydrodynamics and neutron balance equations. The inverse effect of the neutron flux on the gas hydrodynamics is neglected; this condition is satisfied for fluxes between 10^{13} to 10^{14}. Stationary waves are formed in all of the channels of the reactor. NSA

N69-35812# Nuclear Materials and Equipment Corp., Leechburg, Pa. Plutonium Lab.
DEVELOPMENT AND TESTING OF PLUTONIUM OXIDE, URANIUM OXIDE FAST REACTOR FUELS Quarterly Report, Jul. – Sep. 1968
Mar. 1969 18 p refs
(Contract AT(30-1)-3524)
(NUMEC-3524-58; QR-14) Avail: CFSTI

Fission of nuclei by resonance-energy neutrons is reviewed, through 1967, in the context of the channel theory of A. Bohr. Recent developments in the techniques of measuring cross sections of fissile nuclides are discussed. The data are examined in the light of giving evidence on spin dependencies of fission widths, mass distributions, fragment kinetic energies, and other fission properties. It is concluded that not only do these properties depend on spin, but they most probably also depend on the quantum characteristics of the fission saddle-point. Author (NSA)

N69-35817*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF TUNGSTEN AND DEPLETED URANIUM IN MINIMUM-WEIGHT, LAYERED SHIELDS FOR A SPACE POWER REACTOR
Gerald P. Lahti and Paul F. Herrmann Washington Sep. 1969 17 p refs
(NASA-TM-X-1874; E-5079) Avail: CFSTI CSCL 18J

The weights of layered spherical shields for a fast spectrum 2.2-megawatt-thermal nuclear space power reactor have been calculated for two candidate gamma shield materials, tungsten and depleted uranium, using natural lithium hydride as the material for neutron shielding. Each shield configuration was optimized to a dose rate constraint of 2 millirem per hour at 20 meters. A one-dimensional discrete ordinates transport program and a steepest-descent method optimization program were used. Author

N69-35829# Nuclear Materials and Equipment Corp., Apollo, Pa.
DEVELOPMENT AND TESTING OF PLUTONIUM DIOXIDE-URANIUM DIOXIDE FAST REACTOR FUELS Quarterly Report, Oct. – Dec. 1968
Dec. 1968 47 p refs
(Contract AT(30-1)-3524)
(NUMEC-3524-62; QR-15) Avail: CFSTI

Fast breeder reactor (FBR) fuels development work is reviewed. The status of three program tasks are discussed: (1) stagnant sodium capsule tests, EBR-2 fuel irradiation, and post irradiation examination, (2) assessment of commercial fuels (PuO_2-UO_2 mixed oxide runs, and oxygen to metal ratio control), and (3) high confidence testing of prototype FBR fuels. E.C.

N69-35848*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EVALUATION OF THE ICOHORT 2 MONTE CARLO SHIELDING CODE: GAMMA RAY TRANSPORT USING SOURCE DIRECTION BIASING
Harvey S. Bloomfield and Lester Clemons, Jr. Washington Sep. 1969 9 p refs
(NASA-TM-X-1877) Avail: CFSTI CSCL 18F

An evaluation of the gamma ray transport portion of the COHORT II Monte Carlo shielding code is presented. This evaluation was accomplished by solving the point source, infinite medium, scattering problem and comparing COHORT II output spectra with the widely accepted moments method solution of the same problem. In addition, the COHORT II source angular biasing option was shown to be a valid technique for reduction of variance. Author

N69-35868# Pakistan Inst. of Nuclear Science and Technology, Islamabad. Reactor Theory Div.
RESONANCE ABSORPTION IN KANUPP LATTICE
Rashid A. Bhatti and M. A. Mannan 1968 49 p refs
(PINSTECH/RT-1) Avail: AEC Depository Libraries

Resonance integrals were calculated for a 19-rod cluster of UO_2 fuel elements in a heavy water cooled and moderated lattice in the Karachi Power Reactor. The first collision probability was calculated by taking explicitly into account the heterogeneity of the cluster. Resonance integrals calculated by this method were compared to calculations by the homogeneous method and the rational approximation method. Computer codes developed for performing the calculations are outlined. NSA

N69-35985# Douglas United Nuclear, Inc., Richland, Wash.
COMPUTER PROGRAM FOR FAULT TREE ANALYSIS
P. A. Crosetti Apr. 1969 29 p
(DUN-5506) Avail: CFSTI

The fault tree analysis technique is used to describe the critical reactor systems and to provide quantitative performance

results. The computer program presented is used for evaluating the functional performance of nuclear reactor protective systems in terms of system reliability and availability. The Monte Carlo fault tree simulation program is written in FORTRAN 5 for the UNIVAC 1108. NSA

N69-35999# Oak Ridge National Lab., Tenn.
EFFECT OF STEAM DENSITY ON REACTIVITY IN THREE STEAM COOLED FAST BREEDER REACTORS
F. G. Welfare 23 May 1969 17 p refs Sponsored by AEC
(ORNL-TM-2582) Avail: CFSTI

The effect of changes in steam density on reactivity has been calculated for three steam cooled breeder reactors of 3600, 2500, and 1200 psi operating pressure. When flooded at end of life the systems show reactivity increases of 4%, 1%, and 16% for the high, intermediate, and low-pressure systems. When voided at beginning of life the systems show increases in reactivity of .5%, 2%, and .9% for the high, intermediate, and low-pressure systems. When voided at end of life the intermediate, and low-pressure systems show increases in reactivity of 1.9% and 0.7%, respectively, and the high-pressure system shows a decrease in reactivity of 3.8%. Author (NSA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N69-34879# Electrotechnical Lab., Tokyo (Japan).
STUDIES OF THE STANDARD MAGNETIC MEASUREMENT
Tadashi Sasaki Nov. 1968 144 p refs In JAPANESE; ENGLISH summary *Its* Res. NO. 692
Avail: CFSTI

Measurements of magnetic properties are carried out for the improvement of demagnetizing curves and for standardization of testing methods. Uncertainties caused by magnetic after-affects are discussed. Results indicate the after-effect constant decreases and time decreases of magnetic flux are stabilized by heat treatments. Experiments to determine coercive force and magnetic after-effect constants were carried out on permanent magnets. Monocrystalline alnico was produced by the Bridgman method and similar measurements were carried out on the material. Author

N69-34741*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
FLUCTUATIONS AND SCATTERING OF SLOW NEUTRONS AND ELECTROMAGNETIC WAVES IN PARAMAGNETS IN A STRONG MAGNETIC FIELD [FLUKTUATSII I PROTSESSY RASSEYANIYA MEDLENNYKH NEYTRONOV I ELEKTROMAGNITNYLCH VOLN V PARAMAGNETIKAKH V SILMOM MAGNITNOM POLE]
I. A. Akhiyezer et al Washington NASA Aug. 1969 12 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 14, no. 2, p 216–226
(Contract NASw-1692)
(NASA-TT-F-12396) Avail: CFSTI CSCL 20C

Fluctuations and scattering of slow neutrons and electromagnetic waves in paramagnets placed in a strong magnetic field are studied, taking into account couplings between elastic waves and oscillations of magnetic moments of atoms. Fluctuation correlators of values characterizing the paramagnet are determined. The influence of a strong magnetic field on scattering of flow neutrons and electromagnetic waves is studied. The distribution of scattered electromagnetic waves and slow neutrons are shown to alter considerably when approaching the point of magnetoacoustic resonance. Author

N69-34757# France. Ministere de l'Air, Paris.
THE INFLUENCE OF LIGHTING FOR READING NAVIGATION MAPS [L'INFLUENCE DE L'ECLAIRAGE POUR LA LECTURE DES CARTES DE NAVIGATION]
A. Mercier, G. Perdriel, and J. Chevaleraud *In* AGARD Pattern Recognition. Body Armour and Aircrew Equipment Assemblies. Current Space Med. Probl. Aeromed. Evacuation Oct. 1968 13 p In FRENCH (See N69-34751 20-04)
Avail: CFSTI

Questionnaire results from 163 navigators of military and civilian aircraft are addressed to the problem of the lighting mode preferred in the reading of navigational maps. Red or white or mixed light effects were evaluated. Both nighttime and daytime considerations were involved. The majority of navigators preferred mixed lighting (during both rolling and take-off, and they abandoned red lighting to some degree during the cruising phase of flight when maximum use of map reading occurs. Questions regarding lighting intensity, the ease of adaptation to exterior viewing needs, the fatigue produced by different lighting conditions, and the choice of French-type or American-type maps were also put to the navigators; responses were unanimous in favor of control of the red element in lighting conditions. Transl. by M.H.E.

N69-34885# Forsvarets Forskningsanstalt, Stockholm (Sweden).
PREPARATORY WORK WITH THE VIEW OF AN INVESTIGATION OF RESONANCE PHENOMENA IN FERRITES . . . TAENKT UNDERSOERNING AV RESONANSFENOMEN I FERRITER]
K. Hanzon and P. E. Ljung Sep. 1967 15 p refs In SWEDISH; ENGLISH summary
(FOA-3-C-3535-61) Avail: CFSTI

Using existing apparatus, an attempt to examine the high frequency resonance phenomena in ferrites was made. Special attention is given to the coupling between resonances of high and low frequency. Results show that a rational experimental work necessitates the use of more and better instruments, especially for investigation in the far infrared part of the spectrum and that more accurate resonances here would provide important data for research in this seldom used part of the electromagnetic wave spectrum. Author

N69-34893# Forsvarets Forskningsanstalt, Stockholm (Sweden).
TABLES FOR SOUND VELOCITY IN SEA WATER AT SEA LEVEL WITH LOW AND MEDIUM VALUES OF THE SALT CONTENT AND TEMPERATURE [TABELLER OEVER LJUDHASTIGHET I HAVSUATTEN AVSEDDA FOER GRUNDA HAV VID LAGA TILL MEDELHOEGA VAERDEN HOS SALTHALT OCH TEMPERATUR]
[1968] 43 p In SWEDISH
(FOA-3-A-3697-57) Avail: CFSTI

The tables published by Kuwahara in 1939 have been revised using empirical data. Velocity data are shown for surface level and depths of 50 m and 100 m, for water temperatures from 0° to 30° C at 0.5° intervals, and for salt content from 0 to 40 per mill in 1 per mill intervals. Transl. by K.W.

N69-34904# West Virginia Univ., Morgantown. Engineering Experiment Station.
A METHOD OF DETERMINING THE ACTIVATION ENERGY OF THE LONG AND SHORT TIME CONSTANT COMPONENTS OF THE ABSORPTION CURRENT OF CARNAUBA WAX
Nelson S. Smith, Jr. Oct. 1968 32 p refs
(Grant NSF-GP-2313)
(Rept-4; PB-183232) Avail: CFSTI CSCL 11G

The apparent ability of many dielectric materials to collect a volume and a surface charge upon the application of a potential difference and then to gradually release this charge upon the removal of the potential difference has long defied complete explanation. A means of separating the charging current, called the dielectric absorption current, into long and short-time constant components and a method of computing the activation energies of these components is outlined in this paper. This method of studying the behavior of the activation energies of the components of dielectric absorption currents should prove a useful tool in the development of a more complete theory of the behavior of dielectrics.
Author (USGRDR)

N69-34912*# Santa Clara Univ., Calif.
INVESTIGATION OF THE USE OF THE KERR MAGNETO-OPTIC EFFECT FOR THE MEASUREMENT OF MAGNETIC FIELDS, PHASE 2 Final Report
Raymond B. Yarbrough and Frank S. Greene, Jr. Apr. 1969 54 p refs Sponsored by NASA
(NASA-CR-73357) Avail: CFSTI CSCL 20C

The results of the continued investigation of the use of magneto-optic field detector with cross-field pumping are reported, including theoretical consideration of sensitivity and resolution. The calculations are statistical and assume approximately normal distribution of dispersion of easy-axis. The measurement system is described and experimental results are presented. The report is limited to the use of the Kerr longitudinal magneto-optic effect.
Author

N69-34941# California Univ., Livermore. Lawrence Radiation Lab.
OPTIMIZATION STUDIES FOR THE FIDLER DETECTOR
C.L. Lindeken and J. J. Koch *In its* Hazards Control, No. 31 Aug. 1968 p 20-24 (See N69-34938 20-14)
Avail: CFSTI

Results of an investigation of the relative responses of a 2-in.-diameter NaI(Tl) crystals 1/16, 1/8, 1/4, 1/2, 1, and 2 in. thick for detection of 17-, 60-, and 185-keV X radiation are presented.
NSA

N69-34978# Forsvarets Forskningsanstalt, Stockholm (Sweden).
CALCULATION OF OPTIMUM COLOR STIMULUS COORDINATES [BERAEKNING AV OPTIMALFAERGSTIMULIS KOORDINATER]
P. Steen Oct. 1967 13 p refs In SWEDISH
(FOA-2-C-2193-51) Avail: CFSTI

The boundaries of the C.I.E. colors have been calculated to indicate the coordinates corresponding to the optimum standard observer stimuli. The results of the calculations are shown in the form of contour curves on C.I.E. chromaticity charts for four different color sources. An excerpt from a tabulated computer printout of the corresponding numerical values is included.
Transl. by K.W.

N69-34979# Forsvarets Forskningsanstalt, Stockholm (Sweden).
INVESTIGATION OF DIFFERENT METHODS FOR CALCULATING SPECTRAL TRI-STIMULUS VALVES [UNDERSOEKNING AV OLIKA METODER ATT BERAEKNA SPEKTRALA TRISTIMULUSVAERDEN]
P. Steen Oct. 1967 56 p refs In SWEDISH
(FAO-2-C-2194-51) Avail: CFSTI

The various methods are compared in respect to their accuracy. Conventional methods were evaluated as well as the Simpson formula, selected ordinates with constant mass, selected ordinates with sums of equidistant weight functions, and the Gauss quadrature. The tests and computations established that the measuring points should be taken at every 10 nm according to the recommendations of the C.I.E. A reduction in the number of measuring points results in a marked deterioration of accuracy.
Transl. by K.W.

N69-35129# Istituto Superiore delle Poste e delle Telecomunicazioni, Rome (Italy).
LIGHT SCATTERING BY PARTICLES SUSPENDED IN A TURBULENT FLUID
Mario Bertolotti, Bruno Crosignani, Paolo di Porto, and Daniele Sette 5 Jul. 1968 7 p refs
Avail: CFSTI

The spectrum of light scattered by particles suspended in a turbulent fluid is theoretically investigated.
Author (ESRO)

N69-35165# Commissariat à l'Energie Atomique, Limeil (France).
APPLICATION OF COHERENT OPTICS TO PATTERN RECOGNITION [APPLICATION DE L'OPTIQUE COHERENTE A LA RECONNAISSANCE DES FORMES]
Jean-Michel Jego May 1969 41 p refs In FRENCH; ENGLISH summary
(CEA-BIB-145) Avail: CFSTI

After a discussion of the mathematical bases of diffraction theory and spatial filtering the principles of pattern recognition are considered. Methods for producing suitable filters for isolating a signal from additive noise are presented and some applications of pattern recognition using coherent optics are described.
Author (ESRO)

N69-35208# European Space Research Inst., Frascati (Italy).
STEADY STATE CHARGE NEUTRAL MODELS OF THE MAGNETOPAUSE
W. Alpers May 1969 24 p refs Submitted for publication
Avail: CFSTI

Plane models of the magnetopause are investigated under the assumption that ionospheric electrons are able to short-circuit electric fields (exact charge neutrality). Using the Vlasov theory a general method is presented for constructing distribution functions that lead to given magnetic field and tangential bulk velocity profiles. As an example the magnetic field transition is described in terms of error functions and particle distributions in explicit form, are obtained, including bulk velocities. It is thus shown that bulk velocities in the direction of the magnetic field do not necessarily lead to a non-equilibrium magnetopause which investigations by Parker and Larche seem to suggest.
Author (ESRO)

N69-35263# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ADDITIONAL LOSSES IN A FRAME TYPE MHD CHANNEL

B. B. Volchek et al Jan. 1969 12 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Izv. Energ. i Transp. (USSR), no. 1, 1968 p 142–147
(AD-687626; FTD-HT-23-1229-68) Avail: CFSTI CSCL 10/2

A process of calculating the magnitude of the electric currents generated in the conducting frames of Hall generators in a plane parallel to the direction of the main magnetic field and of determining the non- or pre-joulean losses resulting from the existence of these currents is described. A schematic of the Hall generator is presented. Author (TAB)

N69-35286*# Southampton Univ. (England).
THE TRANSIENT RESPONSE OF COUPLED ACOUSTO-MECHANICAL SYSTEMS
A. Craggs Washington NASA Aug. 1969 82 p refs
(Grant NGR-52-025-003)
(NASA-CR-1421) Avail: CFSTI CSCL 20A

The behavior of a coupled plate acoustic cavity system is studied using a computer orientated technique. Some simplifying assumptions are made about the nature of the cavity pressure; it is assumed to be uniform and a function of the volume displacement of the boundary. The plate system is represented by an assemblage of rectangular finite elements and the equations of motion are expressed in terms of displacements; the effect of the cavity is simply to introduce an extra stiffness matrix term. The simplifying assumptions are removed and both the plate and acoustic systems are idealized using finite elements, the acoustic system being formulated in terms of pressures. The results show that where the window is large and flexible, and the cavity small, the in vacuo normal modes become coupled and there is a change in the natural frequencies of the system, and consequently a considerable modification to the in vacuo response. The acoustic finite element results show that in the frequency range excited by sonic booms the acoustic responses of a room with one flexible window are dominated by the lower plane wave depth modes. Author

N69-35292# RAND Corp., Santa Monica, Calif.
APERTURE AVERAGING OF OPTICAL SCINTILLATION
H. T. Yura and R. F. Lutomirski Apr. 1969 23 p refs
(Contract DAHC15-67-C-0141; ARPA Order 189-1)
(AD-688411; RM-5902-ARPA) Avail: CFSTI CSCL 17/21

The aperture-averaging factor of a circular aperture is derived. This factor gives the effect of a finite receiving aperture on spherical and plane waves in reducing the variance of a fluctuating light signal. Curves of the reduction factor and normalized signal standard deviation as a function of range and receiver aperture diameter are presented and are compared with those which were previously calculated. It is shown that Frieds results agree with the results obtained here only for propagation distance where the average field is down by a factor of the order e to the -1 power. TAB

N69-35324# New York Univ., N.Y. Lab. for Electroscience Research.
TOPICS IN LEAKY SPACE-CHARGE WAVES, PART 2
Yen-Chu Wang Jan. 1969 72 p refs
(Contract Nonr-285(66))
(AD-686852; TR-402-2) Avail: CFSTI CSCL 20/8

The report is the second of two parts dealing with the leaky space-charge waves, associated with Cerenkov radiation (Part I) and Smith-Purcell radiation and Wood anomalies (Part II). Using again Palocz and Oliners self-consistent theory of leaky space-charge waves, we present in Part II the Smith-Purcell radiation effects and Wood anomalies of a modulated sheet beam passing between two parallel planar strip transmission grating. The grating is represented by a multimode network. Author (TAB)

N69-35328# Fondazione Ugo Bordoni, Rome (Italy).
STATISTICAL PROPERTIES OF RADIATION SCATTERED BY A FLUID
Mario Bertolotti, Bruno Crosignani, Paolo di Porto, and Daniele Sette 28 May 1968 17 p refs Sponsored partly by Consiglio Nazl. di Ric. Prepared jointly with Rome Univ.
Avail: CFSTI

The possibility of gaining information about the structure of a medium by means of a photon counting scattering experiment is discussed. A simple formalism gives the statistical behavior of scattered light from the correlation functions of the medium. The actual experimental limitations are also briefly examined. Author (ESRO)

N69-35329# Istituto Superiore delle Poste e delle Telecomunicazioni, Rome (Italy).
A SIMPLE APPROACH TO THE ADIABATIC INVARIANCE FOR AN ELECTROMAGNETIC FIELD
Paolo di Porto, Bruno Crosignani, and Salvatore Solimeno Fondazione U.GO Bordoni 5 Oct. 1968 7 p refs
Avail: CFSTI

The problem of an electromagnetic field contained in a box whose linear dimensions are slowly varying is considered. The application of the energy conservation law leads immediately to the constancy of the ratio E/ω between the energy of the field and its frequency. The adiabatic invariance of the number of photons in the box is thus simply achieved. Author (ESRO)

N69-35376*# Israel Program for Scientific Translations, Ltd., Jerusalem.
SPECTROSCOPIC INVESTIGATIONS OF THE EMISSION OF HOT NITROGEN
Yu. A. Plastinin *In its* High-Temp. Properties of Gases, Phys. Gas Dyn., Thermodyn. and Phys. of Combust. 1969 p 90–97 refs (See N69-35365 20-12)
Copyright. Avail: CFSTI CSCL 20F

This paper treats the emission spectrum of very hot nitrogen in the visible and near infrared regions of the spectrum 5450–8200Å. The spectrum was excited by reflecting a shock wave from the tube end. Measurements in hot nitrogen over the wavelength range indicated are of interest when studying the first positive system of nitrogen $N_2(1+)$. The main shortcoming in obtaining photographs in shock-tube experiments is that the photographic material is insufficiently sensitive in the near infrared region of the spectrum. In the present study the photographic sensitivity was increased by several orders of magnitude using a three-stage image converter, which enabled nitrogen emission spectra to be resolved at time intervals of the order of several tens of microseconds. In addition to photographic recordings, the standard photoelectric method was used to obtain absolute measurements of the radiation intensity. The simultaneous use of these two methods yielded data on the nitrogen system. Author

N69-35384*# Israel Program for Scientific Translations, Ltd., Jerusalem.
IGNITION THEORY OF TWO-PHASE MIXTURES
A. S. Predvoditelev *In its* High-Temp. Properties of Gases, Phys. Gas Dyn., Thermodyn. and Phys. of Combust. 1969 p 129–136 refs (See N69-35365 20-12)
Copyright. Avail: CFSTI CSCL 21B

The ignition theory of combustible gas mixtures can be extended to two-phase mixtures. The energy balance equation is easily formed in this case, and consists of the energy in heating

the gaseous phase and liquid drops, the energy expended on evaporation, and the energy liberated during combustion of the gaseous phase. In addition, the inequality of the temperatures of the gaseous phase and drops must be accounted for; the latter is lower than the temperature of the remaining medium during the evaporation of the drops. The temperature of the drops remains constant as long as evaporation continues. During ignition the temperature of the gaseous medium must be functionally connected with the fuel concentration. It is also assumed that the kinetics of combustion is known, at least in a general form. The energy balance equation can thus be established under the condition that a burning zone is formed about the ignition source. Author

N69-35399# Forsvarets Forskningsanstalt, Stockholm (Sweden).
FORMULAS AND TABLES FOR SOUND VELOCITY IN SEA WATER AT SEA LEVEL WITH LOW AND MEDIUM VALUES OF THE SALT CONTENT AND TEMPERATURE [FORMLER OCH TABELLER OEVER LJUDHASTIGHETEN I GRUNDA HAV VID LAGA TILL MEDELHOEGA VAERDEN HOS SALTHALT OCH TEMPERATUR]
H. Wendt Sep. 1967 16 p refs In SWEDISH
(FOA-3-A-3697-57) Avail: CFSTI

The formula published in 1960 by Wilson and verified in 1964 by the U.S. Naval Oceanographic Office has been simplified and adapted for actual values of temperature, salt content, and pressure existing in Swedish waters. The accuracy of the revised formula is compared with Wilson's original formula. Transl. by K.W.

N69-35416# Naval Electronics Lab. Center for Command Control and Communications, San Diego, Calif.
LIMITATIONS OF SIMPLE COHERENT OPTICAL SYSTEMS Final Report
James L. Harris, Sr. May 1969 19 p
(Contract NObs-90337)
(AD-688467) Avail: CFSTI CSCL 20/6

The Fourier transform relationship between the front and rear focal planes of a simple lens has been used extensively in recent years. One important application has been that of attempting to restore degraded imagery by Fourier transforming the degraded imagery by Fourier transforming the degraded image, performing filtering in the Fourier plane, and accomplishing a second Fourier transform to obtain the restored image. These techniques have direct application to the problem of restoring images degraded by atmospheric turbulence and apply equally well to both temporally variant and temporally invariant degradation. The present report shows that the Fourier transform property is an approximation valid only for low spatial frequencies. At high spatial frequencies the Fourier transform achieved by a simple lens has serious phase errors. These phase errors will place severe limitations upon image restoration operations involving imagery with high spatial frequency content. Author (TAB)

N69-35612# European Organization for Nuclear Research, Geneva (Switzerland).
MAGNETIC CHARACTERISTICS OF THE UNITS OF THE RING MAGNET OF THE 70 GeV PROTON SYNCHROTRON, APRIL – AUGUST 1967 [CARACTERISTIQUES MAGNETIQUES DES UNITES DE L'ELECTRO-AIMANT ANNULAIRE DU SYNCHROTRON A PROTONS DE 70 GeV, AVRIL – AOUT 1967]
I. A. Mozalevski et al Jan. 1969 26 p Transl. into FRENCH from a Sci. Res. Inst. of Electr-Phys. Arp., Leningrad report In FRENCH
(CERN-Trans-69-4) Avail: AEC Depository Libraries

Results are presented from magnetic measurements of ring electromagnet units for the IHEP accelerator. These results cover the period from April to August, 1967. Tables are given for the results of magnetic calibration of the electromagnetic units and for the principle magnetic characteristic types of units. NSA

N69-35669*# Illinois Univ., Urbana.
INVESTIGATION OF THE LUMINESCENT PHENOMENA OF HIGH RESISTIVITY SILICON AND STUDY OF ELECTRICAL CHARACTERISTICS OF TUNNELING INTO LOW RESISTIVITY SILICON Semiannual Progress Report, 20 Sep. – 20 Mar. 1969
W. Dale Compton 15 Apr. 1969 30 p refs Prepared for JPL
(Contracts NASA-100; JPL-952393)
(NASA-CR-105286; SAPR-1) Avail: CFSTI CSCL 20F

Activities in four major research areas are summarized. Although substantial progress was made in each of these during the past six months, measurements are still in progress and final conclusions are not possible at this time. The areas of research are: the study of the influence of uniaxial stress and temperature upon the high resolution luminescence spectra of electron irradiated silicon, the study of the effects of lithium dopant upon the spectra of the recombination luminescence of irradiated silicon, the thermal stability of the defects that are responsible for the recombination luminescence in irradiated silicon, and the influence of irradiation upon the electron tunneling characteristics of highly doped silicon. Author

N69-35688# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
NON-DESTRUCTIVE CONTROL OF EDDY CURRENTS: STUDY OF THE INFLUENCE OF THE SHAPE OF COILED PROBES ON THE SPACE DISTRIBUTION OF MAGNETIC INDUCTION [CONTROLE NON DESTRUCTIF PAR COURANTS DE FOUCAULT: CONTRIBUTION A L'ETUDE DE L'INFLUENCE DE LA FORME DES SONDES BOBINEES SUR LA DISTRIBUTION SPATIALE DE L'INDUCTION MAGNETIQUE]
A. Philippe Jul. 1969 64 p refs In FRENCH; ENGLISH summary
(EUR-4284.f) Avail: CFSTI

The relation connecting the form and the spatial distribution of the magnetic field of a cylindrical probe - which is the basic part for testing material by means of eddy currents - was studied experimentally. Cylindrical, truncated spheroidal, truncated hyperboloidal and conical coils were considered and compared to a straight cylindrical reference concerning the magnetic field distribution. Author

N69-35850*# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
THE EFFECT OF DAMPING, TIME DELAYS AND PARAMETER VARIATIONS ON THE STABILITY OF A NONCONSERVATIVE SYSTEM
E. F. Infante and R. H. Plaut [1969] 24 p refs
(Grants NGR-40-002-015; DA-31-124-ARO-D-270; AF-AFOSR-693-67)
(NASA-CR-105400) Avail: CFSTI CSCL 20K

The stability of the nonconservative double pendulum model is studied with emphasis placed on the effect of changes in the model parameters and on the presence of retardation of the angular position of the follower load. Both the cases of external and internal damping are considered. As in previous studies, the damping is assumed to be small. Author

N69-35824# Fondazione Ugo Bordoni, Rome (Italy).
COMPARISON AMONG THE NOISE RATING METHODS
Italo Barducci, Giovanni Ibba, and Luigi Totaro 10 May 1968 13 p refs Presented at the 5th AICB Intern. Congr., London, 13-18 May 1968
Avail: CFSTI

This paper gives the first results of an experimental investigation on noise rating methods. Author (ESRO)

N69-35943# Joint Publications Research Service, Washington, D.C.
SOUND GENERATION BY SURFACE WAVES CONSIDERING BOTTOM REFLECTIONS AND THE VELOCITY OF SOUND IN WATER AS A FUNCTION OF DEPTH
L. M. Brekhouskith et al 25 Aug. 1969 10 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Fiz Atmosfery i Okeana (Moscow), v. 5, no. 6, 1969 p 608-615
(JPRS-48681) Avail: CFSTI

The effect that the change in the velocity of sound with depth and the presence of an absorbing bottom have on sound generation by interacting waves on the surface of the liquid is considered. The analysis was made for a continuous spectrum of the surface waves. Expressions are obtained for the statistical characteristics of the sound emitted. Several actual cases are studied in detail. The resonance character of the emission is of significance and causes a considerable increase in the amplitude of the sound pressure as compared with the amplitude in the case of an ocean of infinite depth with constand sound velocity. Author

N69-35990# Centre National de la Recherche Scientifique, Bellevue (France). Laboratoire des Hautes Pressions.
ULTRASONIC VELOCITY AND ULTRASONIC ATTENUATION IN HIGH DENSITY FLUIDS BY USE OF PULSE METHOD IN LABORATORY AND ON BOARD THE BATHYSCAPHE ARCHIMEDE [CELERITE ET ATTENUATION DES ULTRASONS DANS LES FLUIDES DENSES PAR LA METHODE DES IMPULSIONS EN LABORATOIRE ET A BORD DU BATHYSCAPHE ARCHIMEDE]
Claude Magnien (Ph.D. Thesis-Paris Univ.) 1969 180 p refs In FRENCH
Avail: CFSTI

A theoretical survey of acoustic propagation and attenuation of ultrasonic radiation in high density media is carried out. A laboratory device has been developed to study acoustic propagation and attenuation in high pressure gases. This equipment is described. An operational device has been designed and results gained on board the bathyscaphe Archimede are presented. ESRO

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N69-34801*# Techtran Corp., Glen Burnie, Md.
CALCULATION OF THE ENERGY OF AN ATOM WITH A CORRECTION DUE TO OSCILLATION IN THE THOMAS-FERMI MODEL [ENERGIYA ATOMA V MODELI TOMASA FERMI S OTSILLYATSIONNOY POPRAVKOY]
O. V. Troshin Washington NASA Aug. 1969 6 p refs Transl. into ENGLISH from Izv. VYSSH. Ucheb. Zaved., Fiz. (Tomsk), no. 4, 1969 p 56-59
(Contract NASw-1895)
(NASA-TT-F-12468) Avail: CFSTI CSCL 20H

The energy of an atomic shell was found with the aid of the variation method and consideration of the oscillating correction, nonanalytical with respect to Planck's constant. The numerical values of energy are 5% to 6% higher than the experimental values for atoms with the order number $Z > 20$. The mathematical apparatus used for determining the energy density of electrons and energy of the electron shell of an atom is given. Author

N69-34899# Liège Univ. (Belgium). Faculté des Sciences.
STUDY OF THE LIFETIME OF EXCITED PARTICLES AND SECONDARY PROCESSES IN ELECTRIC DISCHARGES [ETUDE DES DUREES DE VIE DES PARTICULES EXCITEES ET DES PROCESSUS SECONDAIRES DANS LES DECHARGES ELECTRIQUES]
Francois Remy (Ph.D. Thesis) [1968] 166 p refs In FRENCH
Avail: CFSTI

An experimental device has been designed to evaluate the role played by hydrogen in the excitation in the 4050 group of C_3 during discharge from a hollow cathode. It is shown that the surface properties of the cathode are essential. Results are presented for discharges with nitrogen, hydrogen and argon. ESRO

N69-34723# Mound Lab., Miamisburg, Ohio.
THE EFFECTIVE ALPHA ACTIVITY OF Pu 238 DIOXIDE MICROSPHERES
Gary N. Huffman (M.S. Thesis--Dayton Univ.) Apr. 1969 104 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1642) Avail: CFSTI

Measurements were made of the effective alpha activity emitted at the surfaces of $^{238}PuO_2$ sol-gel microspheres as a function of their spherical diameters. The isotopic ratios and conversion factors for $^{236}Pu/^{239}Pu$ were calculated. Emission fractions and the range of an alpha particle were calculated using Kershner's relationship. The range in plutonium dioxide 238 is found to be 12.3 Author

N69-34727# National Reactor Testing Station, Idaho Falls, Idaho.
MVFC: A COMPUTER PROGRAM FOR CONSTRUCTING FORCE CONSTANT MATRICES FOR USE IN VALENCE FORCE POTENTIAL FUNCTIONS IN MOLECULES AND CRYSTALS
J. K. Boyster and H. L. Mc Murry Apr. 1969 82 p refs
(Contract AT(10-1)-1230)
(IN-1282) Avail: CFSTI

The program described is to become part of a collection of computer programs which provide the means for calculating the slow-neutron scattering by moderators. This scattering depends on the vibrations of the atoms in the moderating materials and these vibrations must first be calculated before the scattering can be determined. This program automates what was one of the most time consuming and error producing processes required for preparing input to programs which calculate the vibrations of molecular and crystalline moderators. Specifically, it sets up the force constant matrices which are used when valence force coordinates (changes in bond distances, interbond angles, etc.) are used to express the potential energy changes which occur during the vibrations. Author (NSA)

N69-34800# Los Alamos Scientific Lab., N. Mex.
PROCEEDINGS OF THE SECOND LAMPF USERS MEETING, 16–17 JANUARY, 1969
Lewis Agnew and Katherine H. Harper, ed. 4 Apr. 1969 70 p refs Conf. held at Los Alamos Sci. Lab., N. Mex., 16–17 Jan. 1969
(Contract W-7405-eng-36)
(LA-4087; Conf-690112) Avail: CFSTI

The present status of the design and construction of the LAMPF accelerator and experimental facilities is described. Also, informal user study sessions on experiments and facilities are outlined. NSA

N69-34824# Forsvarets Forskningsanstalt, Stockholm (Sweden).
SOME ASPECTS ON THE THEORY OF TRANSIENT RADIATION INDUCED DIFFUSION CURRENTS IN SEMICONDUCTOR DIODES
B. Sigfridsson and G. Leman Oct. 1967 18 p refs Presented to the IEEE at the Ann. Conf. on Nucl. and Space Radiation Effects, Columbus, Ohio, 1967
(FOA-4-C-4324-29) Avail: CFSTI

Analytical expressions for the shape of the diffusion component of the current pulses from a reverse biased semiconductor diode irradiated by short bursts of X-rays are derived, taking into account the physical dimensions and the effect of back diffusion of charge carriers into the bulk regions from the depletion zone. By the model used it seems to be possible to explain the experimentally observed variations of both the amplitude and the decay of the diffusion component with the reverse voltage. Author

N69-34822# California Univ., Livermore. Lawrence Radiation Lab.
POPULATION DISTRIBUTIONS. PART 2: CHARGE EXCHANGE CAPTURE BY PROTONS INCIDENT UPON GROUND STATE ATOMS
John R. Hiskes 7 Mar. 1969 27 p refs Sponsored by AEC
(UCRL-50602) Avail: CFSTI

The ratios of the excited captures to the total captures have been computed for charge-exchange collisions of protons incident upon each of the elements in its ground state. The calculations have been performed for incident proton energies of 5 to 140 keV; a simplified form of the Brinkman–Kramers matrix element was employed. Generally speaking the extremes of behavior of the population distributions occur for charge-exchange collisions with the alkali metals and with the inert gases; the population distributions for the other target elements fall smoothly within these extremes. The main variations of the population ratios and the primary trends for different target elements agree reasonably well with available experimental data. Author (NSA)

N69-34840# California Univ., Livermore. Lawrence Radiation Lab.
THE DETECTION OF CHERENKOV LIGHT FROM RADIOACTIVE SOURCES IN WATER
A. E. Wilson (Idaho Univ.), J. F. Tinney, and J. J. Koch *In its* Hazards Control, No. 31 Aug. 1968 p 8–20 (See N69-34938 20-14)
Avail: CFSTI

Theoretical and experimental aspects of detection of neutron-, gamma-, and beta-emitting radioactive sources underwater by Cherenkov light are discussed. The background radiation encountered in seawater is examined. The basic electronic equipment used for detection of Cherenkov light is described. Temperature effects on the photomultiplier tubes were investigated. Preliminary data are presented. NSA

N69-35007# Philipps-Universitat, Marburg (West Germany). Inst. fuer Theoretische Physik.
FORM-FACTORS IN BOOTSTRAP-FORMALISM [FORM-FAKOTOREN IM BOOTSTRAP-FORMALISMUS]
P. Rosenthal Dec. 1968 81 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. Fuer wiss. Forsch.
(BMwF-FBK-68-60) Avail: AEC Depository Libraries

The electromagnetic form factors of elementary particles are discussed in connection with the bootstrap mechanism for the strong interactions. After describing the general approach given recently by Dashen and Frautschi the sample case of the pion form factor is treated schematically. Here, amplitudes with a virtual (iso-vector) photon can be combined with the π-ρ model of the pion to yield a bootstrap relation for the form factor. Author (NSA)

N69-35008# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
COLLISION PROBABILITY CRITICALITY CALCULATIONS
Douglas C. Hunt 16 Apr. 1969 8 p refs
(Contract AT(29-1)-1106)
(RFP-1134) Avail: CFSTI

A method is presented for computing the multiplication factor of single region systems which contain fissile material and which may be specified by one, two, or three coordinates. The systems are assumed to be unreflected, homogeneous assemblies which have no reentrant surfaces. The method follows the successive scattered neutron collisions which take place in a system and computes for each interaction the product of the probability of a fission collision and the average number of secondaries per fission. The sum of these products, in the limit as the number of collisions becomes infinite, is the multiplication factor of the system. Critical sizes are found by obtaining the multiplication factor as a function of the system dimensions and graphically determining the dimensions which make the factor equal unity. The critical dimensions of several plutonium metal and enriched-uranium metal systems are computed and, when possible, the calculated dimensions are compared with experimental values. author (NSA)

N69-35017# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.
COMMENT ON THE CALCULATION OF NEUTRON LIFETIME AND MATERIAL WORTH
Edgar Kiefhaber Nov. 1968 9 p refs
(KFK-882; EUR-4161-E; EURFNR-812) Avail: AEC Depository Libraries

Bilinear averaging has been widely accepted as the adequate procedure for establishing few group perturbation cross sections. The most important differences compared to the usual flux-averaging procedure are generally obtained for the material worths especially of predominantly scattering materials. In addition to these results a strong indication is given that the calculation of the neutron lifetime is also markedly influenced by the averaging scheme used, leading to an underprediction of the calculated value, a fact which is most times observed in comparison with experimental results. Author (NSA)

N69-35028# Argonne National Lab., Ill. High Energy Physics Div.
NUCLEON-ANTINUCLEON INTERACTIONS Symposium
May 1968 215 p refs Symp. held in Argonne, Ill., 9 May 1968
(ANL-HEP-6812; CONF-680533) Avail: CFSTI

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2. REVIEW OF PROTON-NUCLEON ANNIHILATIONS AT REST T. E. Kalogeropoulos (Syracuse Univ., N.Y.) p 17–57 refs (See N69-35030 20-24)

3. TWO-BODY ANNIHILATION IN FLIGHT C. T. Murphy (Mich. Univ., Ann Arbor) p 58–78 refs (See N69-35031 20-24)

4. THEORIES OF ANTINUCLEON-NUCLEON ANNIHILATION: AN EXPERIMENTAL REVIEW D. Cline (Wis. Univ., Madison) p 79–107 refs (See N69-35032 20-24)

5. MULTIPARTICLE FINAL STATES IN ANTIPROTON REACTIONS IN FLIGHT W. A. Cooper p 108–146 refs (See N69-35033 20-24)

6. NUCLEON-ANTINUCLEON ELASTIC AND CHARGE EXCHANGE SCATTERING B. Musgrave p 147–197 refs (See N69-35034 20-24)

7. SOME THEORETICAL ASPECTS AND CONCLUDING REMARKS H. J. (Princeton Univ.) p 198–215 refs (See N69-35035 20-24)

N69-35029# Chicago Univ., Ill.
ANTIPROTON-PROTON ANNIHILATIONS AT REST
N. Gelfand *In* Argonne Natl. Lab. Nucleon Antinucleon Interactions May 1968 p 4–16 refs (See N69-35028 20-24)
Avail: CFSTI

Several properties of the $\bar{p}p$ system are briefly discussed. A summary is given of the results of pionic annihilations of stopped antiprotons. NSA

N69-35030# Syracuse Univ., N.Y.
REVIEW OF PROTON-NUCLEON ANNIHILATIONS AT REST
T. E. Kalogeropoulos *In* Argonne Natl. Lab. Nucleon Antinucleon Interactions May 1968 p 17–57 refs Supported by NSF (See N69-35028 20-24)
Avail: CFSTI

A review is presented of pN annihilations, which is based primarily on bubble chamber studies by the Syracuse-Rome collaboration. Some of the questions and conclusions concerning the spectator hypothesis, the S-capture hypothesis, and the triplet singlet competition are discussed. Branching ratios for pionic annihilations, kaonic annihilations and the pN/pp ratio are discussed. Data on pionic and kaonic annihilations are then reviewed. NSA

N69-35031# Michigan Univ., Ann Arbor.
TWO-BODY ANNIHILATION IN FLIGHT
C. T. Murphy *In* Argonne Natl. Lab. Nucleon Antinucleon Interactions May 1968 p 58–78 refs (See N69-35028 20-24)
Avail: CFSTI

The data on $\bar{p}p \rightarrow \pi^+\pi^-$, $\bar{p}p \rightarrow K^+K^-$ and $\bar{p}p \rightarrow K^0\bar{K}^0$ annihilations above 200 MeV/c are summarized. Cross sections are given for annihilations into other two-body final states. NSA

N69-35032# Wisconsin Univ., Madison.
THEORIES OF ANTINUCLEON-NUCLEON ANNIHILATION: AN EXPERIMENTAL REVIEW
David Cline *In* Argonne Natl. Lab. Nucleon Antinucleon Interactions May 1968 p 79–107 refs (See N69-35208 20-24)
Avail: CFSTI

The present theoretical understanding of NN interactions is discussed from the standpoint of problems which are subject to experimental clarification. The summary is divided into two parts, discussion of low energy NN interactions (below ~ 1 GeV/c p momentum) and a discussion of models that presumably apply at considerably higher momentum. NSA

N69-35033# Argonne National Lab., Ill.
MULTIPARTICLE FINAL STATES IN ANTIPROTON REACTIONS IN FLIGHT
W. A. Cooper *In its* Nucleon Antinucleon Interactions May 1968 p 108–146 refs Supported by AEC (See N69-35028 20-24)
Avail: CFSTI

A review is given on bubble chamber studies of antiproton reactions with hydrogen and deuterium. Multiplicity, angular correlations, and cross sections for pionic and kaonic annihilations are discussed. The data are also reviewed on single and double pion production and two- and three-body hyperon production in nonannihilation interactions. NSA

N69-35034# Argonne National Lab., Ill.
NUCLEON-ANTINUCLEON ELASTIC AND CHARGE EXCHANGE SCATTERING
B. Musgrave *In its* Nucleon Antinucleon Interactions May 1968 p 147–197 refs Supported by AEC (See N69-35028 20-24)
Avail: CFSTI

A review is given of presently available experimental data on NN elastic and charge exchange scattering. The low energy region with anti-nucleon kinetic energies below 300 MeV is first considered. The experiments illustrating the following features of pp elastic scattering are then discussed; a pronounced forward peak, a minimum in the direct channel, and a sharp backward peak. The data on pp charge exchange scattering above 1 GeV/c are reviewed. NSA

N69-35035# Princeton Univ., N.J. Palmer Physical Lab.
SOME THEORETICAL ASPECTS AND CONCLUDING REMARKS
H. J. Lipkin *In* Argonne Natl. Lab. Nucleon Antinucleon Interactions May 1968 p 198–215 refs Supported in part by AEC and the Higgins Sci. Trust Fund (See N69-35028 20-24)
Avail: CFSTI

Some theoretical aspects of NN annihilations are discussed. These include coherence and interference effects, t-channel amplitudes, symmetry predictions, and quark model predictions. NSA

N69-35040# International Centre for Theoretical Physics, Trieste (Italy).
A UNIFIED TREATMENT OF LEPTONS
A. O. Barut, P. Cordero (Chile Univ.), and G. C. Ghirardi (Trieste Univ.) Apr. 1969 15 p refs Submitted for publication (IC/69/26) Avail: CFSTI

In an attempt at a unified treatment of leptons it is shown that a wave equation based on the most general conserved current operator for a vertex can describe all known leptons with their physical masses. The appearance of only three masses is implied by the general assumptions. The O(4, 2) treatment of massive spin 1/2 particles is extended to massless particles, and a unified labelling of all leptonic states is found. The electromagnetic and weak interactions of leptons are then written in terms of the matrix elements of currents with their corresponding gage transformations. Author (ESRO)

N69-35041# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.
CONTRIBUTION TO THE STUDY OF DEFECTS CREATED BY α-IRRADIATION IN URANIUM AT 4.2 °K [CONTRIBUTION A L'ETUDE DES DEFAUTS CREES PAR IRRADIATION A L'AIDE DE PARTICLES α DANS L'URANIUM A 4.2 °K]
André L. Raharinaivo (Ph.D. Thesis - Nancy Univ.) Feb. 1969 80 p refs In FRENCH; ENGLISH summary
(CEA-R-3668) Avail: CFSTI

A device is described for the irradiation of metallic strips in liquid helium, by α particles from radioactive sources which made it possible to measure changes in the resistivity of variously treated uranium samples (cold-worked, annealed, previously exposed to neutrons, etc.) as a function of the irradiation flux. Annealing carried out after irradiation compares favorably Jousset's experiments with those effected after quenching from 100 to 4 °K. The results are discussed and it is concluded that a defect, very probably of the interstitial type is mobile in uranium at temperatures below 5 °K. Author (ESRO)

N69-35045# Academia R. P. R., Bucharest. Institutul de Fizica Atomica.
PROTONIC AND DEUTERONIC MOTIONS IN PARTIALLY DEUTERATED GLYCERINE BY COLD NEUTRON SCATTERING TECHNIQUE
S. Rapeanu 1968 24 p refs
(IFA-FN-35) Avail: AEC Depository Libraries

The cold neutron spectrometer at the Stockholm reactor R_1 was used to measure the quasi-elastic and inelastic scattering of cold neutrons on partially deuterated glycerine at 266 (glass and liquid phase), 293, 334, and 369 °K. The angles of scattering, ψ, ranged from 20° to 90°. The resolution of the improved instrument was 20 μs/m or 2% at 4 Å. The linewidth data as a function of the square of the moment transfers at various temperatures were compared to the theoretical linewidth curves in accordance to some dynamic models; the best fitting was with the Larsson's model. The ratios of the residence times τ_0 derived for partially deuterated glycerine and those for natural glycerine were close to $\sqrt{2}$. Also, the ratio between the frequencies of the peaks assigned to hindered rotations of the proton in the OH group in natural glycerine and of the deuteron in the OD group in partially deuterated glycerine, was found to be close to $\sqrt{2}$, as it should be if the proton and deuteron, respectively, are the dynamic units. Author (NSA)

N69-35048# Oak Ridge National Lab., Tenn. Neutron Physics Div.
PHOTONUCLEAR DISINTEGRATION AT HIGH (LESS THAN 350 MeV) ENERGIES
T. A. Gabriel (Ph.D. Thesis - Univ. of Tenn.) and R. G. Alsmiller, Jr. 12 Feb. 1969 82 p refs
(ORNL-TM-2481; PB-183554) Avail: CFSTI CSCL 20H

Calculations of high-energy (40 to 350 MeV) photon-nucleus (A greater than or equal to 12) collisions have been carried out. The results of the initial interaction of the photon with the nucleus are obtained either from the quasi-deuteron model of Levinger or, when energetically possible, from one of the four pion, nucleon statec formed in photon-nucleon interactions. The effect of nucleon-(pion-) nucleus interactions that follow the initial photon interaction is taken into account by using an intranuclear-cascade model. The results of the calculations are compared with a variety of experimental data, and good agreement is obtained. Author (USGRDR)

N69-35063# University Coll., London (England). Dept. of Physics.
THE N IVλ 5820 MULTIPLET IN WN STARS
H. Nussbaumer [1969] 6 p refs Sponsored by ESRO
Avail: CFSTI

A computer program developed for the calculation of atomic structures, oscillator strengths and collision cross sections in complex atoms has been applied to solve a problem in the stellar spectroscopy of Wolf-Rayet stars to decide whether a spectral line at 5810 originates from C IV or N IV. It is argued that it is due to C IV. ESRO

N69-35083# Kyoto Univ. (Japan). Research Reactor Inst.
REPORT OF SPECIAL COMMITTEE ON NONDESTRUCTIVE TESTING
Yukinori Katsurayama and Tadashi Tsujimoto [1967] 57 p refs In JAPANESE Presented at two conf. held 22 Mar. and 28 Sep. 1966
(KURRI-TR-30) Avail: CFSTI

The report comprises six papers which were presented at two conferences held on March 22, and September 28, 1966. The papers include Status of Radiography Using ^{192}Ir, Neutron Radiography, Thickness Determinations with the Use of Radiation, Integrity Testing using ^{192}Ir, Problems in Designing Pressure Vessels, and Testing Specifications for Pressure Vessels. The last paper covers testing by radiation transmission measurements, supersonic testing for faults, and magnetic particle inspection. NSA

N69-35091# General Electric Co., Schenectady, N.Y. Knolls Atomic Power Lab.
ESTIMATORS FOR SHIELDING MONTE CARLO CALCULATIONS: A REVIEW
D. B. MacMillan 13 Jun. 1968 19 p refs Presented at the 14th Annual Meeting of the Am. Nucl. Soc., Toronto, 9–13 Jun. 1968
(Contract W-31-109-eng-52)
(KAPL-P-3435) Avail: CFSTI

The problem of estimating reaction rates (or flux integrals over finite energy ranges) is considered in spatial objects for steady state neutron and gamma ray Monte Carlo calculations. Both shielding Monte Carlo calculations and core Monte Carlo calculations are presented. The estimators described are: (1) for flux or reaction rate in a volume, (2) for point, line, and surface, (3) for flux or reaction rate at a point, (4) for flux or reaction rate at a line, and (5) for flux or reaction rate at a surface. F.O.S.

N69-35092# Denver Univ., Colo. Dept. of Physics.
ULTRA-HIGH ENERGY INTERACTIONS
M. Koshiba [1969] 33 p refs Presented at the 10th Intern. Conf. on Cosmic Rays
(Grant NSF GP-5564)
Avail: Issuing Activity

A summary of available data on high energy interactions is presented and analyzed to form a working model with a minimum of adjustable parameters. The two prevailing models at the conference which are presented in schematics are: (1) two fire-ball, and (2) isobar-pionization. Other subjects discussed were cross-sections, multiplicity, angular distribution, composition of secondary particles, momentum distribution, inelasticity, forward-backward asymmetry, and transverse momentum. A discussion of the Aleph + pionization model is included. F.O.S.

N69-35178# Turin Univ. (Italy). Istituto di Fisica Generale.
KAON PRODUCTION FROM MUONS [PRODUZIONE DI K + DA μ]

G. Navarra and P. Penengo [1969] 11 p refs In ITALIAN Sponsored by Consiglio Nazl. delle Ric.
Avail: CFSTI

The nuclear interactions of muons are examined and the production of different particles by muons passing through rock layers is considered on the assumption that the processes depend on the electromagnetic field of muons. Both the methods suggested by Weizsa Acker and Williams and by D. Kessler and P. Kessler are examined. The computations were carried out with the aid of an Elea 601 computer. ESRO

N69-35177# University Coll., London (England). Dept. of Physics.
A PROGRAM FOR CALCULATING ATOMIC STRUCTURES
W. Eissner and H. Nussbaumer [1969] 34 p refs Sponsored by ESRO and Culham Lab.
Avail: CFSTI

A method for calculating atomic structure problems suitable for the electronic computer is outlined; the method allows for configuration interaction in a very general way. It is based on the expansion of wave functions in terms of Slater states. All relativistic interactions are disregarded and an SL coupling scheme is used. The number of terms SL considered is that resulting from all configurations included; the configurations are the only input apart from the nuclear charge Z. The energy matrix is expressed in terms of radial integrals with purely algebraic coefficients. A scheme is described for computing these coefficients. The integrals are evaluated using radial wave functions calculated in a scaled Thomas-Fermi potential. Numerical examples for Na I and Mg I isoelectronic sequences are given. Layzer pointed out the importance of configuration interaction within a complex; his predictions for stages of high ionization are confirmed. It is shown that for stages of medium or low ionization interaction with configurations out of other complexes can become important. Author (ESRO)

N69-35196# Columbia Univ., Irvington, N.Y. Nevis Labs.
NEUTRON ASYMMETRY IN MUON CAPTURE
John Sculli (Ph.D. Thesis) Mar. 1969 58 p refs
(Grant NSF GP-6206)
(PB-183458; F-655; CU-272; NEVIS-168) Avail: CFSTI CSCL 20H

The neutron asymmetry in muon capture in Ca40 has been measured by detecting neutrons in an array of spark chambers and scintillation counters. The detection scheme permits a measurement of neutron energies in the region 10-30 MeV with 10% resolution. Five thousand neutrons recorded above 16 MeV give an asymmetry +0.45 plus or minus 0.29 contrary to the large negative asymmetries obtained in earlier experiments and opposite in sign to predictions based on the V-A theory and approximate descriptions of the nuclear physics. Author (USGRDR)

N69-35197# Columbia Univ., Irvington, N.Y. Nevis Labs.
SEARCH FOR TIME REVERSAL INVARIANCE VIOLATION IN NEGATIVE PION p YIELDS NEUTRON POSITRON ELECTRON
William Ross (Ph.D. Thesis) Jan. 1969 90 p refs
(Grant NSF GP-6206)
(PB-183457; R-651; CU-271; NEVIS-167) Avail: CFSTI CSCL 20H

The report describes an experiment looking for a violation of time reversal. Time reversal invariance requires the vanishing of the expectation value of sigma sub n X (p sub + X p sub -) X (E sub + - E sub -). On the basis of 296 acceptable events, we measure a raw asymmetry proportional to this expectation value of -0.09 plus or minus 0.09. If we include angular resolution factors and weight events by their theoretically expected contribution to the asymmetry, we get-0.11 plus or minus 0.13 The measured asymmetry in sigma sub n X(p sub + X p sub-), which is expected to vanish if charge conjugation invariance is valid for leptons, is -0.02 plus or minus 0.10. Author (USGRDR)

N69-35200# California Univ., Berkeley. Lawrence Radiation Lab.
NOTES ON PION PION SCATTERING. PART 3: J-PLANE PHENOMENA
D. Sivers and Joel Yellin 17 Jan. 1969 38 p refs
(UCRL-18665) Avail: CFSTI

The discussion of $\pi + \pi$ scattering covers properties of Legendre functions, a review of Regge poles in the scattering of spinless equal-mass particles, and the J-plane behavior of the Veneziano model for $\pi\pi \rightarrow \pi\pi$ interactions. Partial fraction expansions, the Froissart – Gribov partial wave amplitudes, location of moving poles in the J-plane, fixed poles in the J-plane, and the asymptotic behavior of $\beta(t)$ are also discussed. NSA

N69-35209# American Nuclear Society, Hinsdale, Ill. Reactor Physics Div.
RESONANCE CROSS SECTIONS IN THE UNRESOLVED RESONANCE REGION AND APPLICATION OF MONTE CARLO TECHNIQUES TO REACTOR PHYSICS Proceedings of Summer Meeting, 1968
13 Sep. 1968 195 p refs 1968 Summer Meeting of the Am. Nucl. Soc. and the Can. Nucl. Assoc. held in Toronto, 10. 12 Jun. 1968
(ANS-RPD-1) Avail: CFSTI

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1. UNRESOLVED RESONANCE REGION CROSS SECTIONS AND REACTOR CALCULATIONS J. L. Russell, Jr. (Gulf Gen. Atomic) 14 p refs (See N69-35210 20-24)

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3. NEUTRON CROSS-SECTION MEASUREMENTS SPANNING THE RESOLVED-TO-THE-UNRESOLVED RESONANCE REGION R. C. Block (Rensselaer Polytech., Inst., Troy, N.Y.) 21 p refs (See N69-35212 20-24)

4. INTERFERING RESONANCES P. A. Moldauer (Argonne Natl. Lab., Ill.) 17 p refs (See N69-35213 20-24)

5. STUDIES OF UNRESOLVED RESONANCES WITH A 2 keV BEAM O. D. Simpson and L G. Miller (Idaho Nuclear Corp.) 21 p refs (See N69-35214 20-24)

6. RESONANCE PARAMETER DISTRIBUTIONS FOR INTERFERING RESONANCES R. A. Freeman and J. D. Garrison (San Diego State College) 18 p refs (See N69-35215 20-24)

7. APPLICATION OF MONTE CARLO METHODS IN REACTOR PHYSICS M. R. Mendelson (GE Co., Schenectady, N.Y.) 23 p (See N69-35216 20-22)

8. APPLICATIONS OF MONTE CARLO TO PROBLEMS IN REACTOR DESIGN AND EXPERIMENTAL ANALYSIS L B. Levitt (Atomics International, Canoga, Calif.) 12 p refs (See N69-35217 20-22)

9. DEVELOPMENT AND USE OF MONTE CARLO TECHNIQUES IN REACTOR DESIGN AT UNITED NUCLEAR CORPORATION F. R. Nakache (United Nuclear Corp.) 21 p refs (See N69-35218 20-22)

10. THE APPLICATION OF MONTE CARLO TO NEUTRON TRANSPORT AND REACTOR ANALYSIS PROBLEMS AT THE EURATOM RESEARCH CENTER ISPRA H. Rief (European Atomic Energy Community, Ispra, Italy) 19 p refs (See N69-35219 20-22)

N69-35210# Gulf General Atomic, San Diego, Calif.
UNRESOLVED RESONANCE REGION CROSS SECTIONS AND REACTOR CALCULATIONS
John L. Russell, Jr. *In* Am. Nucl. Soc. Resonance Cross Sect. in the Unresolved Resonance Reg. and Appl. of Monte Carlo Tech. to Reactor Phys. 13 Sep. 1968 14 p refs (See N69-35209 20-24)
(CONF-680601-55) Avail: CFSTI

Effects of scattering resonances in the unresolved region are considered from the view of their effects on reactor calculations. Methods of treating resonance data for some heavy metals are described; accuracy of calculational techniques is evaluated; methods for measuring resonance data are analyzed. Results of comparisons of experiment and theory are shown graphically. NSA

N69-35211# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
STATISTICAL TREATMENT OF RESONANCE ABSORPTION IN THE UNRESOLVED RESONANCE REGION
M. W. Dyos *In* Am. Nucl. Soc. Resonance Cross Sect. in the Unresolved Resonance Reg. and Appl. of Monte Carlo Tech. to Reactor Phys. 13 Sep. 1968 18 p refs (See N69-35209 20-24)
(CONF-680601-48) Avail: CFSTI

A statistical method for calculating resonance absorption in the unresolved resonance region is given. Statistical methods are reviewed; the validity of distribution functions for the resonance parameters is assessed. Results of the calculations are discussed. Values for resonance integrals are tabulated. NSA

N69-35212# Rensselaer Polytechnic Inst., Troy, N.Y.
NEUTRON CROSS-SECTION MEASUREMENTS SPANNING THE RESOLVED-TO-THE-UNRESOLVED RESONANCE REGION
Robert C. Block *In* Am. Nucl. Soc. Resonance Cross Sect. in the Unresolved Resonance Reg. and Appl. of Monte Carlo Tech. to Reactor Phys. 13 Sep. 1968 21 p refs (See N69-35209 20-24)
(CONF-680601-46) Avail: CFSTI

The resolved and unresolved resonance region is defined from an experimentalist's point of view; energy level and neutron energy resolution diagrams are shown. Capture cross section measurements for ^{183}W are plotted as capture yield vs. neutron-time-of-flight; ^{183}W transmission is shown, also, as a function of neutron-time-of-flight. A comparison of the measurement techniques of the pulsed white source of neutrons and neutron-time-of-flight is given; use of these techniques in resolved and unresolved resonance regions are considered briefly. The s and p wave components of the neutron capture cross section are shown as a function of energy. Spin state assignments for plutonium 239 are tabulated. NSA

N69-35213# Argonne National Lab., Ill.
INTERFERING RESONANCES
P. A. Moldauer *In* Am. Nucl. Soc. Resonance Cross Sect. in the Unresolved Resonance Reg. and Appl. of Monte Carlo Tech. to Reactor Phys. 13 Sep. 1968 17 p refs (See N69-35209 20-24)
(CONF-680601-52) Avail: CFSTI

Elements for which resonance interference becomes the dominant feature in cross section behavior are listed. Characteristics of isolated resonances are reviewed; statistics of isolated resonance parameters are summarized. Statistics of resonance pole parameters for interfering resonances are discussed. Properties of the interfering resonance poles are determined; these are compared to non-interfering resonance poles. Pole statistics are detailed; examples of calculations are shown graphically. Resultsof S-matrix and statistical model calculations are shown. NSA

N69-35214# Idaho Nuclear Corp., Idaho Falls.
STUDIES OF UNRESOLVED RESONANCES WITH A 2 keV BEAM
O. D. Simpson and L. G. Miller *In* Am. Nucl. Soc. Resonance Cross Sect. in the Unresolved Resonance Reg. and Appl. of Monte Carlo Tech. to Reactor Phys. 13 Sep. 1968 21 p refs (See N69-35209 20-24)
(CONF-680601-56) Avail: CFSTI

Neutron cross section variation measurements as a function of energy in the unresolved region are described. Measurements, made in the MTR, utilized a scandium neutron filter with a fast chopper. Beam intensity and neutron flux greater than 2 keV are given for the HB-3 beam hole. Background, gamma beam intensity, and attainable beam diameters are described. Results of measurement of change in cross section as a function of sample temperature are discussed; comparisons of 2 keV fission cross section data are tabulated. Mock calculations of ^{181}Ta and ^{239}Pu cross section dependence on energy are discussed; data are shown graphically. Average resonance parameters for ^{239}Pu from Saclay, ENDF-B, and LASL are tabulated. NSA

N69-35215# San Diego State College, Calif.
RESONANCE PARAMETER DISTRIBUTIONS FOR INTERFERING RESONANCES
R. A. Freeman and J. D. Garrison *In* Am. Nucl. Soc. Resonance Cross Sect. in the Unresolved Resonance Reg. and Appl. of Monte Carlo Tech. to Reactor Phys. 13 Sep. 1968 18 p refs (See N69-35209 20-24)
(CONF-680601-49) Avail: CFSTI

The distributions of Kapur–Peierls or Humblet–Rosenfeld resonance parameters and spacings for a variety of interference conditions have been obtained by Monte Carlo calculations in the two-resonance approximation using the distribution of R-matrix resonance parameters and spacings and the mathematical connection between the R-matrix and Kapur–Peierls cross section formulations. The R-matrix distributions are assumed the same under all conditions of inteference. Author (NSA)

N69-35223# Forsvarets Forskningsanstalt, Stockholm (Sweden).
CALCULATION OF STATE CHARACTERISTICS BY MEANS OF THE THOMAS-FERMI-KIRZHNITS MODEL [BERAEKNING AV TILLSTANDSEGENSKAPER MED THOMAS-FERMI-KIRZHNITS MODELL]
Nils Gylden and Bo Einarsson Oct. 1967 63 p refs In SWEDISH
(FOA-2-C-2190-23) Avail: CFSTI

The general background of the original Thomas-Fermi theory and of the extended Thomas-Fermi-Kirzhnits (TFK) theory is discussed, and the behavior of the "exact" quantum mechanical density near radius = 0 is examined in detail. It is found that the TFK theory is invalid in principle near the nucleus, and a center correction is introduced for an improved solution. This correction does not interfere with the applicability of the solutions for all atomic numbers. A single derivation for pressure is given. An iteration method is used for solving the equations for given values of volume and temperature and for numerical calculations of the atomic states. The results are compared with Hartree-Fock calculations of total atomic energies. Transl. by K.W.

N69-35230# Allgemeine Elektricitaets-Gesellschaft, Grosswelzheim (West Germany). Kernenergieversuchsanlage.
FAST STEAM COOLED REACTOR: SYSTEM PRESSURE CONSIDERATION, 300 MWe PROTOTYPE AND AN APPROPRIATE TEST BED FOR FUEL ELEMENTS

J. Fischer, P. Kilian, and A. Kirchemayer *In* Am. Nucl. Soc. Fast Reactor Systems, Mater. and Components [1969] p 111–126 refs (See N69-35227 20-22)
Avail: CFSTI

A system pressure of 120 atmosphere was found suitable for the prototype of the steam-cooled fast reactor by considering economic influences and development risks. A preliminary design for the 300 MW(e) prototype is proposed. Essential features are a direct cycle, a pressure-suppression containment and a steel pressure vessel with the Löffler cycle components arranged in compact loops. For fuel testing, an all fast reactor is proposed. The core and main components can be housed in the existing pressure vessel of the superheat reactor. Author (NSA)

N69-35233# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.
RADIATION EFFECTS TO REFRACTORY METALS AND ALLOYS
John Moteff *In* Am. Nucl. Soc. Fast Reactor Systems, Mater. and Components [1969] p 225–243 refs (See N69-35227 20-22)
(Contract AT(40-1)-2847)
Avail: CFSTI

A general review is made of the effects of neutron irradiation on the elevated temperature mechanical properties of refractory metals and alloys. Particular attention is paid to the importance of the irradiation and test temperature and to the resulting substructure on the observed changes in the mechanical properties. Author (NSA)

N69-35274# Techtran Corp., Glen Burnie, Md.
OSCILLATION CORRECTION FOR DENSITY OF ELECTRONS OF AN ATOM [OSTILLYATSIONNAYA POPRAVKA K PLOTNOSTI ELEKTRONOV ATOMA]
O. V. Troshin Washington NASA Aug. 1969 10 p refs Transl. into ENGLISH from Iz. Vyssh. Ucheb. Zav., Fiz. (Tomsk), no. 4, 1969 p 90–96
(Contract NASw-1695)
(NASA-TT-F-12469) Avail: CFSTI CSCL 20H

The oscillation correction for the electron density of an atom in the Thomas–Fermi model is calculated with the aid of Green's functions and continual integration. This correction yields a nonanalytical dependence on Planck's constant and cannot be derived by the ordinary methods using expansion with respect to a proportionally smaller parameter. Author

N69-35294# Saskatchewan Univ., Saskatoon. Accelerator Lab.
ANNUAL REPORT, SEPTEMBER 1967 - NOVEMBER 1968
Dec. 1968 91 p refs
(SAL-12) Avail: AEC Depository Libraries

Research carried out in the period September, 1967 at the Saskatchewan Accelerator Laboratory to November, 1968 is described. Modifications to the electron linear and the design of a storage ring are discussed. Data are reported on electrodisintegration and photodisintegration experiments on light nuclei as well as other reactions involving the bremsstrahlung and electron scattering facilities. NSA

N69-35336# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
COHERENT BREMSSTRAHLUNG OF ELECTRONS IN CRYSTALS
U. Timm Mar. 1969 80 p refs
(DESY-69/14) Avail: AEC Depository Libraries

The interferential phenomena of high energy bremsstrahlung in crystals are considered. It is explained how the kinematical restrictions of the process and the interferential selection of nuclear recoils act together to obtain an energy-proportional intensity spectrum and high linear polarization. Formulas for intensity and polarization as functions of quantum energy are presented and discussed, particularly with respect to experimental limitations. The work is based on experimental and theoretical investigations carried out at electron energies of 6 GeV. Author (NSA)

N69-35360# Commissariat a l'Energie Atomique, Saclay (France).
GASEOUS ULTRACENTRIFUGE FOR THE SEPARATION OF THE URANIUM ISOTOPES [LES ULTRACENTRIFUGEUSES A GAZ POUR LA SEPARATION DES ISOTOPES DE L'URANIUM]
Bourgain, le Manach and Berthoumieux [1968] 19 p In FRENCH Presented at Symp. on Probl. Bearing on Isotope Separation of Uranium, Turin, 1–2 Oct. 1968
(CEA-CONF-1269; CONF-681015-5) Avail: AEC Depository Libraries

Several prototypes of centrifuges have been perfected in France by the CEA. Their operation is safe and their power of separation is close to the theoretical. With the purpose of increasing the income from the process all efforts lead to the reduction of the investments, the decrease of the electric power, and the increase of the peripheral speeds. The results obtained make it possible to hope that centrifugation will become an economical process in the near future for use in isotopic separation of average amounts. Among theoretical studies, we shall cite those related to the mechanics of deformable and nondeformable solids, the studies of pieces in rotation in connection with the mechanics of continuous media, thermal studies, and aerodynamic studies. In the domain of technology we shall cite the metallurgical studies, the studies of bearings and supports, and studies of air- and water-tight devices. Author (NSA)

N69-35361# Commissariat a l'Energie Atomique, Saclay (France).
THEORY OF ISOTOPIC SEPARATION BY GASEOUS DIFFUSION ACROSS A MEMBRANE. EFFECT OF THE INTERNAL STRUCTURE OF THE MEMBRANE [THEORIE DE LA SEPARATION ISOTOPIQUE PAR DIFFUSION GAZUESE A TRAVERS UNE MEMBRANE. EFFECT DE LA STRUCTURE INTERNE DE LA MEMBRANE]
[1968] 15 p refs In FRENCH Presented at Symp. on Probl. Bearing on Isotope Separation of Uranium, Turin, 1–2 Oct. 1968
(CEA-CONF-1271; CONF-681015-4) Avail: AEC Depository Libraries

It is possible to interpret by calculation, at least qualitatively, the influence of the structure of the porous medium on the flux and the efficiency of separation by introducing a distribution coefficient P_c that is a function of the length (λ) of the segments supported by the partition. Unfortunately, it appears that this distribution $P_c(\lambda)$, or the structure of the porous region, cannot be favorable simultaneously to the permeability and to the efficiency of separation. Author (NSA)

N69-35405# Stanford Linear Accelerator Center, Calif.
DIGITAL COMPUTER ERROR ANALYSIS OF A RESONANT TOROID CHARGE MONITOR
Dale Horelick and Raymond S. Larsen Mar. 1969 25 p refs
(Contract AT(04-3)-515)
(SLAC-100) Avail: CFSTI

A mathematically exact error analysis is performed on an ideal resonant toroid charge monitor for varying beam pulse width, assuming calibration with a known impulse charge. An optimum

waveform sampling point is derived from the data, which minimizes the error. The effects of using a rectangular calibration pulse are analyzed, and the error for an impulse beam is calculated as a limiting case of beam charge distribution. Errors for variation in system timing are also analyzed. All computations are performed on a digital computer to obtain the required precision. The results show that a maximum error of results show that a maximum error of ± 0.012% can be achieved over a pulse width range of 0-2 μsec, with a resonant frequency of 5.25 kHz and a damping time constant of 0.33 msec. Under the same conditions the maximum timing error is about -0.07%/μsec. Author (NSA)

N69-35412# International Centre for Theoretical Physics, Trieste (Italy).

CROSSING RELATIONS FOR HELICITY AMPLITUDES

Yasuo Hara May 1969 20 p refs Submitted for publication (IC-69-38) Avail: CFSTI

The crossing relations between s-channel and u-channel amplitudes were found by the author, but the overall phase factor remains to be determined for the case where s-channel and t- or u- channel reaction are not identical, which is done starting from a definition of the phases of the initial and final helicity states. Author (ESRO)

N69-35413*# STD Research Corp., Pasadena, Calif.

NOVEL METHOD FOR DETERMINATION OF ENERGY-LOSS FACTORS FOR SLOW ELECTRONS IN HOT GASES Interim Report, 28 Apr. 1966 – 30 Jun. 1968

1 Aug. 1968 12 p refs

(Contract NAS2-3580)

(NASA-CR-73361; STD-68-2) Avail: CFSTI CSCL 20H

The energy-loss factor is determined by a new method that employs a high-frequency (2.45 GHz) electric field to elevate the temperature of the electrons above the temperature of the gas and a Langmuir probe to determine the electron temperature. The electron energy-loss factor δ_x in a given gas x is then determined by measuring the rate of change of the electron temperature with the high-frequency power used to illuminate the plasma. The determination of δ_x by this method does not require knowledge of the collision cross sections for momentum transfer or of other transport coefficients or of the number densities of the electrons and neutral particles present. An arc heater was used to generate the hot gas. The energy state of the gas was determined spectroscopically. It is concluded that this is a valid and accurate method for determining energy-loss factors since the experimentally obtained values are in essential agreement with theoretical predictions for various gases over a range of more than two orders of magnitude in the loss factor. Author

N69-35417# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.

SPECTRAL REPRESENTATIONS AND RENORMALIZATION OF SPINORIAL QUANTUM FIELDS

B. V. Medvedev, M. K. Polivanov, and A. D. Sukhanov 1969 9 p refs In RUSSIAN; ENGLISH summary

(ITF-69-9) Avail: AEC Depository Libraries

The spectral representations of the spinorial field with possible contributions from one-particle states are successively derived. Formulas relating the mass and field renormalization constants to the integrals of two spectral densities and expressions of the vacuum expectation values for the equal-time commutators and for a one-particle matrix element are derived. Author (NSA)

N69-35423# Atomic Energy Establishment, Winfrith (England). General Reactor Physics Div.

MONTE CARLO CALCULATIONS OF NEUTRON AGE IN SOME MODERATING MEDIA

M. Veale Jul. 1968 10 p refs

(AEEN-M-833) Avail: CFSTI/UK

A brief description is given of a Monte Carlo code written to determine the neutron age in a homogeneous medium, and its subsequent use in resolving certain discrepancies in age calculations, especially in light water is described. The code utilises the DICE structure and is a by-product of a larger Monte Carlo project. Author (NSA)

N69-35424# New Mexico State Univ., Las Cruces. Dept. of Physics.

PHENOMENOLOGICAL LAMBDA-N POTENTIALS AND LAMBDA BINDING IN NUCLEAR MATTER

B. Ram [1968] 13 p refs Presented at the Intern. Conf. on Hypernucl. Phys., Argonne, Ill. 5 – 7 May 1969

(Conf-690503-1) Avail: CFSTI

Effective central, spin-dependent S-wave Λ-N potentials of a variety of shapes that fit the previous scattering lengths (a_s = −1.8F, a_t = 1.6F) are constructed. These potentials, assumed to be appropriate in all angular momentum states, are then used to: calculate the binding energy of the Λ particle in nuclear matter by the method of independent pair approximation and study its variation with various parameters; calculate the Λ-N total scattering cross sections in order to estimate the percent reduction of the potentials in odd-parity states that fit the Λ-p scattering data, previously found, and their dependence of the type of potential; and then to obtain an approximate measure of the noncentral components in the Λ-N interaction. NSA

N69-35428# Science Research Council, London (England). Rutherford High Energy Lab.

NIMROD OPERATION AND DEVELOPMENT Quarterly Report, 1 Oct. – 31 Dec. 1968

D. E. Gray, ed. Feb. 1969 22 p refs

(RHEL/R-178) Avail: CFSTI; UK 4s 0d

Work reported includes the following: operation of the Nimrod accelerator; development of switched extraction magnet power supply; current stabilization; radiation protection (radiation measurements around extracted proton beams; biological dosimetry, contamination resulting from failure of uranium target); radiation dosimetry (inner vacuum vessel). The experimental program is also summarized. NSA

N69-35429# Science Research Council, London (England). Rutherford High Energy Lab.

THE WORK OF THE RUTHERFORD LABORATORY IN 1968

A. P. Banford and F. M. Telling 1969 138 p refs

(RHEL/R-180) Avail: AEC Depository Libraries; UK 15s 0d

Work is described on a wide range of topics, including elastic scattering cross-sections and polarizations, bubble chamber studies, and investigations concerned with weak interactions. Some of this work has involved the use of advanced spark chamber and on-line computer techniques. Two NIMROD extracted proton beams have been in use, with ability to switch from one to the other during the pulse. The report is divided into the following sections: High energy physics division; NIMROD division; proton linear

accelerator division; applied physics division; engineering division; and administration division. A list of publications by the staff is also included. NSA

N69-35447# Los Alamos Scientific Lab., N.Mex.
TAILORED SPECTRA FROM 14 MeV SOURCES
Darryl B. Smith and H. O. Menlove [1968] 4 p Presented at the Intern. Conf. on the Constructive Uses of Atomic Energy, Washington, D.C. Supported by AEC
(LA-DC-9756; CONF-681101-27) Avail: CFSTI

Neutron transport calculations using the DTF-4 transport code have been directed toward maximum neutron leakage and desired spectral characteristics from various moderator assemblies. Calculations (one space dimension) were performed with a 14 MeV neutron source at the center of moderating assemblies consisting of concentric shells of various materials with varying radii. Author (NSA)

N69-35451# Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.
EIGHTH CRACOW SCHOOL OF THEORETICAL PHYSICS, VOLUME 1 Proceedings
A. Bialas, J. Kwiecinski, A. T. Lee, J. Rayskin, Ph. Salin et al Jul. 1968 146 p refs Symp. sponsored by Inst. of Nucl. Phys., The Jagellonian Univ., and the State Council for Peaceful Uses of Nucl. Energy, Zakopane, Poland, Jun. 1968
(INP-622/PL/PH-Vol-1) Avail: AEC Depository Libraries

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7. POSITIVE KAON PROTON PHASE SHIFT ANALYSIS AND THE POSSIBLE EXISTENCE OF A Z_1 RESONANCE A. T. Lee (Natl. Inst. for Res. in Nucl. Sci.) p 105–146 refs (See N69-35458 20-24)

N69-35452# Jagellonian Univ., Cracow (Poland). Inst. of Physics.
ON A RADICAL REMOVAL OF THE CONVERGENCE DIFFICULTIES Introductory Talk
Jerzy Rayski *In* Polish Acad. of Sci. 8th Cracow School of Theoret. Phys. Jul. 1968 p 1–7 (See N69-35451 20-24)
Avail: AEC Depository Libraries

A method is presented for computing scattering amplitues which avoids the usual convergence difficulties. A partial process represented by a connected graph in momentum representation is called a primitive process or channel. The process is first analyzed into primitive channels; conditioned probability amplitudes are then computed for each channel separately using for each a suitable parameter P_r. The parameters P_r are later identified with eigenvalues of energy-momentum. NSA

N69-35453# European Organization for Nuclear Research, Geneva (Switzerland).
STRUCTURE OF THE SCATTERING AMPLITUDES FOR HIGH ENERGY COLLISIONS
Philippe Salin *In* Polish Acad. of Sci. 8th Cracow School of Theoret. Phys. Jul. 1968 p 8–27 refs (See N69-35451 20-24)
Avail: AEC Depository Libraries

Some difficulties encountered by the Regge pole model for high energy scattering are discussed. The first problem discussed is related to kinematic singularities in transversity amplitudes, cross sections, and density matrix elements. The problem of constraints is then considered. It is shown that these technical complications may be avoided through the use of S-channel helicity amplitudes. NSA

N69-35454# European Organization for Nuclear Research, Geneva (Switzerland).
SOME PHENOMENOLOGICAL IMPLICATIONS OF THE REGGE POLE MODEL
Philippe Salin *In* Polish Acad. of Sci. 8th Cracow School of Theoret. Phys. Jul. 1968 p 28–38 (See N69-35451 20-24)
Avail: AEC Depository Libraries

It is shown that the cross section for any quasi two-body reaction can be split in a model independent way into natural and unnatural parity parts. Applications are made to photoproduction experiments and baryon resonance production. Implications of evasion and conspiracy are discussed. NSA

N69-35455# Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.
THE QUARK MODEL
Andrzej Bialas and Kacper Zalewski *In its* 8th Cracow School of Theoret. Phys. Jul. 1968 p 39–74 (See N69-35451 20-24)
Avail: AEC Depository Libraries

The application of the quark model to two-body scattering processes is reviewed. The following topics are discussed: wave functions of particles in terms of quarks; small angle scattering; large angle scattering; backward scattering; form factors; symmetry; and some detailed results of the quark model. NSA

N69-35456# Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.
SUPERCONVERGENCE AND FINITE ENERGY SUM RULES
Jan. Kwiecinski *In its* 8th Cracow School of Theoret. Phys. Jul. 1968 p 75–84 refs (See N69-35451 20-24)
Avail: AEC Depository Libraries

The foundation and some applications of the superconvergence relations and their generalization to finite energy sum rules are discussed. The application of superconvergence relation is illustrated in the case of meson-baryon scattering within SU(3) symmetry. NSA

N69-35457# Commissariat a l'Energie Atomique, Saclay (France). Departement de Physique des Particules Elementaires.
POLARIZATION IN HIGH ENERGY MESON-NUCLEON SCATTERING
P. Sonderegger *In* Polish Acad. of Sci. 8th Cracow School of Theoret. Phys. Jul. 1968 p 85–104 refs (See N69-35451 20-24)
Avail: AEC Depository Libraries

The various experimental methods used for polarization measurements are reviewed. Some relevant experiments in meson–nucleon scattering are described, and their results are interpreted qualitatively in terms of the Regge pole model. NSA

N69-35458# National Inst. for Research in Nuclear Science, Chilton (England). Rutherford High Energy Lab.
POSITIVE KAON PROTON PHASE SHIFT ANALYSIS AND THE POSSIBLE EXISTENCE OF A Z SUB 1 RESONANCE
Andrew T. Lea *In* Polish Acad. of Sci. 8th Cracow School of Theoret. Phys. Jul. 1968 p 105–146 refs (See N69-35451 20-24)
Avail: AEC Depository Libraries

The basic formalism for KN scattering is first reviewed and the electromagnetic corrections needed are discussed. A rather detailed study of the experimental data is given, and the results of fitting all the differential cross-section data with a Legendre polynomial series are presented. This is followed by a description of some necessary assumptions made and of the techniques employed. The results are presented and suggestions are made for future experiments. NSA

N69-35488# Brandeis Univ., Waltham, Mass. Dept. of Physics.
RESEARCH IN ELEMENTARY PARTICLE PHYSICS Technical Progress Report, 31 May 1969
Lawrence Kirsch and Howard J. Schnitzer 31 May 1969 11 p refs
(Contract AT(30-1)-3178)
(NYO-3178-6) Avail: CFSTI

Research performed on both theoretical and experimental physics is described. This research is either previously published or is under analysis and includes a study of $S = -1$ baryons in the range 1600 to 1740 MeV, search for the kappa meson, ξ^0 production, the reactions $K^- + p \rightarrow \Sigma^+ 4\pi$, $K^- + p \rightarrow \Lambda + 5\pi$, and $K^- + n \rightarrow \Sigma^- + \pi^0$, the Ward identity for current algebra, transverse parts of current algebra amplitudes, and current algebra at short distances. NSA

N69-35485# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
RENORMALIZATION OF THE YANG-MILLS THEORY WITH NON-ZERO MASS
A. A. Slavnov 1969 12 p refs Presented at 3rd Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev, Apr. 1969
(ITF-69-20; CONF-690417-3) Avail: AEC Depository Libraries

Renormalizability of Yang-Mills theory with arbitrary mass is established. Explicit expression for effective renormalizable Lagrangian is given. Author (NSA)

N69-35487# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
METHOD OF SEPARABLE EXPANSION OF TWO-PARTICLE T-MATRIX AND THREE-BODY PROBLEM
V. F. Kharchenko and N. M. Petrov 1969 32 p refs In RUSSIAN, ENGLISH summary
(ITF-69-8) Avail: AEC Depository Libraries

The three-body problem for the case when the total energy of the three-nucleon system is negative, is treated by means of separable expansions of a two-particle t-matrix. By expanding the wave function of system in the angular functions the Fadeyev equations are reduced to an infinite system of bound homogeneous integral equations which can be cut short in case of forces with a finite radius of action. The system of three identical spinless particles and that of three nucleons is considered. For the case of Hulten's local potential the binding energies of the triton and neutron-deuteron scattering are calculated. Author (NSA)

N69-35508*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A COMPUTER PLOTTING DESCRIPTION OF ION-MOLECULE COLLISIONS WITH LONG-LIVED CAPTURE COMPLEXES
John V. Dugan, Jr. and James H. Rice Washington Sep. 1969 30 p refs
(NASA-TN-D-5407) Avail: CFSTI CSCL 20H

Spiraling in ion molecule collisions with polarizable and/or polar targets is investigated numerically using computer plotting techniques. Collision orbits and interaction behavior are studied for a range of collision parameters on the IBM 360/67 and 7094 computers with the CDC DD280 plotter. Multiple reflections off a hard core barrier at small ion molecule separations occur only in collisions with permanent dipoles. Multiple reflection times for 2 to 2000 reflections are 10 to 10^3 times longer than times for single reflections. Long multiple reflection collision times, however, do no mean large capture cross sections; the capture cross section values are much less than those predicted by the adiabatic theory. Author

N69-35509# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE POSSIBILITY OF GENERATION AND RECEPTION OF GRAVITATIONAL RAYS
V. R. Nagibarov et al 20 Feb. 1969 16 p refs Transl. into ENGLISH from Izv. Vyssh. Uchab. Zaved., Fiz. (Tomsk), v. 10, no. 9, 1967 p 66–72
(AD-687636; FTD-MT-24-386-68) Avail: CFSTI CSCL 20/10

The authors showed earlier that by means of a laser ray it is possible to excite harmonic oscillations of quadrupole mass moments of atomic electron shells. It follows from the theory of weak gravitational fields that this should lead to the generation of gravitational waves in the optical range by mass quadrupole electron shells. If the linear dimensions of the laser-excited specimen are much longer than the length of the generated gravitational waves, then the coherent part of the gravitational emission will have a sharp directivity, and it naturally should be called a gravitational ray. Generally, electromagnetic waves will be emitted together with the gravitational waves. This leads to the fact that only an insignificant share of the energy stored by the system from the laser beam will be in the form of gravitational waves. The authors investigate the feasibility of development of superemission gravitational and nonemission electromagnetic states of a system of N-particles with a descrete spectrum by using laser technology and excitation of particles in a two-quantum mode. An evaluation is made of the parameters, and requirements are defined for systems which may generate the detected force of coherent gravitational waves of optic and gamma frequencies. The fundamental circuit of a coherent gravitational ray receiver is described. TAB

N69-35543# Illinois Univ., Urbana. Dept. of Mining, Metallurgy, and Petroleum Engineering and Materials Research Lab.
HIGH-RESOLUTION FIELD ION MICROSCOPY
Hua-Ching Tong (Ph.D. Thesis) Oct. 1968 136 p refs
(Contract AT(11-1)-1198)
(COO-1198-622) Avail: CFSTI

Defects induced on both the surfaces and the interiors of tungsten wires were studied. Atomic rearrangements on the surfaces caused by strong electric fields were observed. The fine structures of atomic groupings (metastable molecules) at special sites were resolved for the first time. The groupings are classified as triplets, quadruplets, quintuplets, and higher orders. Tungsten specimens were bombarded inside the field ion microscope with

energetic helium atoms (with kinetic energies ranging from 100 eV to 5 keV). Some specimens were rotated to place their axes parallel with the ion beam during the bombardment. Others were bombarded in the usual way from the side. Defects generated by the helium–ion bombardment were identified as vacancies, interstitials, and vacancy clusters. Low-temperature interstitial migration was observed between 10 and 50°K. Grain boundaries acting as sinks for interstitials were also observed. Finally, the sputtering threshold energy for a field ion tip was measured. Author (NSA)

N69-35544# Daresbury Nuclear Physics Lab. (England).
DARESBURY NUCLEAR PHYSICS LABORATORY Annual Report, 1968
1969 72 p refs
(NP-17900) Avail: AEC Depository Libraries

Details are given of the organization of the Laboratory, and the work carried out in experimental physics. The information is presented under the following headings: Introduction; experimental physics; theoretical physics; physics apparatus and measurements; computer work; operation and future development of the electron synchrotron NINA; machine physics investigations; engineering; and administration. Author (NSA)

N69-35550# California Inst. of Tech., Pasadena.
ENERGY LEVELS OF LIGHT NUCLEI: A EQUALS 13
Fay Ajzenberg-Selove (Haverford Coll.) May 1969 89 p refs
Prepared by Haverford Coll. for Calif. Inst. of Tech., Pasadena.
(Contract Nonr-220(47); Grants NSF GP-8035; NSF GP-9114)
(AD-688468) Avail: CFSTI CSCL 20/8

The paper gives a preliminary draft of a compilation of information on energy levels and reactions involving 13Be, 13B, 13C, 13N, and 13O. Author (TAB)

N69-35560# Rensselaer Polytechnic Inst., Troy, N.Y.
A MONTE CARLO CODE FOR NEUTRON CAPTURE EXPERIMENTS
J. G. Sullivan (ORNL), G. G.Warner (ORNL), R. C. Block, and R. W. Hockenbury [1969] 39 p refs
(Contract AT(30-3)-328)
(RPI-328-155) Avail: CFSTI

A Monte Carlo code for calculating neutron capture cross sections is described. The cross-section formula used is discussed and the program outline and flow chart are given. NSA

N69-35564# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
INELASTIC INTERACTIONS OF HIGH-ENERGY PROTONS WITH ATOMIC NUCLEI
V. S. Brashenkov, K. K. Gudima, and V. D. Toneev 1969 25 p refs In RUSSIAN
(JINR-P2-4402) Avail: AEC Depository Libraries

The Monte-Carlo method is used to calculate the intranuclear cascades initiated by protons of an energy from a few dozens of MeV to about 30 GeV. The law of energy-momentum conservation and the meson production processes are exactly taken into account. The evaporation from excited residue-nuclei is calculated. In the whole energy range from a few dozens of MeV to about 5 GeV the results of calculations are in good agreement with experiment; at higher energies there appear noticeable discrepancies in the characteristics of the low-energy component of produced particles. These discrepencies grow with increasing energy of the primary nucleon. An analogous disagreement between the experimental results and those obtained by the usual cascade theory appears in the case of pion-nuclear interactions. Author (NSA)

N69-35586# Oak Ridge National Lab., Tenn. Neutron Physics Div.
SOME CALCULATED MILESTONE SOLUTIONS TO TIME-DEPENDENT RADIATION TRANSPORT PROBLEMS
E. A. Straker, W. W. Engle, Jr., and P. N. Stevens 22 Apr. 1969 37 p refs
(ORNL-TM-2499) Avail: CFSTI

In developing time-dependent transport computer codes it is helpful to have some typical problems for which the answers are believed to be known. Thus reproducibility of these results provides confidence in the use of new techniques. Some time-dependent results are presented for three problems: (1) one-speed isotropic scatterer with nonabsorption probabilities of 0.3 and 0.9; (2) a point 12.2- to 15-MeV neutron source in infinite homogeneous air; and (3) a point fission neutron source in infinite homogeneous air. Both Monte Carlo and discrete ordinates techniques were used in determining time-dependent results at 3, 6, and 9 mean free paths for problem 1 and at 300, 600, and 900 meters for problems 2 and 3. Author (NSA)

N69-35584 Centre d'Etudes et de Recherches en Technologie Spatiale, Toulouse (France).
PROGRAM FOR COMPUTATION OF RADIATION DOSES [PROGRAMME DE CALCUL DE DOSE]
J. Brettes and J.-P. Philippon *In its* Determination of Radiation Doses in Space 1968 p 139–164 refs In FRENCH; ENGLISH summary (See N69-35576 20-29)
Copyright Avail: Activity

One can compute the electron and proton doses impinging on a satellite over one or many orbits so long as the orbital parameters are known. This computation is made in three stages: a) Orbit computation, b) Transformation of geographical coordinates into B and L coordinates and c) Dose computation. Two methods are given for the transformation of the coordinates: a) The classical one (McIlwain method) and b) The perturbation one which is sufficiently accurate in almost all cases and reduces the computation time. Author (ESRO)

N69-35585 Compagnia Generale di Elettricitta S.p.A., Milan (Italy).
A METHOD FOR ESTIMATING PARTICLE FLUXES AFFECTING A SATELLITE IN SPACE
G. Quaranta *In* CERTS Determination of Radiation Doses in Space 1968 p 165–171 refs (See N69-35576 20-29)
Copyright Avail: Issuing Activity

A method for computing electron and proton fluxes impinging on a spacecraft is described and a computer program is summarized. The computation is performed for Van Allen belts and solar flares by introducing orbital parameters. Output data from the program can be immediately used to obtain damage estimates for electronic components and materials for the computation gives integrated spectra for Van Allen electrons and protons and for solar protons. These spectra are converted separately into 1 MeV electron fluxes for computing solar cell power output decrease. Furthermore, the output spectra are converted into fast neutron equivalent fluxes for transistor damage studies, and in rads dose units for other components and materials. Author (ESRO)

N69-35597 Lyon Univ. (France). Institut de Physique Nucléaire.
GROUND SIMULATION EQUIPMENT OF SPACE NUCLEAR RADIATION. VALIDITY OF THE SIMULATION AND THE

EQUIVALENCE OF RADIATION EFFECTS [MOYENS DE SIMULATION AU SOL DES RAYONNEMENTS NUCLEAIRES SPATIAUX. VALIDITE DE LA SIMULATION ET EQUIVALENCE DE L'EFFET DES RAYONNEMENTS]

J. Pigneret, J. J. Samuell, and A. Serazin *In* CERTS Determination of Radiation Doses in Space 1968 p 341-370 refs In FRENCH; ENGLISH summary (See N69-35576 20-29)

Copyright. Avail: Issuing Activity

The first part of this survey concerns ground simulation methods of space nuclear radiation. The different types of possible particle sources are analyzed (accelerators, generators, sources, cells) and operating principles, range of energy and intensity and techniques of stabilization, as well as the methods of production by nuclear reactions are discussed. Furthermore, the methods used for dosimetry are indicated as well as problems set by exposure of large size samples. The second part concerns the analysis of the simulation validity in a laboratory and the equivalence of radiations: spectral problems, delivery time, flux isotropy, additivity effects. Author (ESRO)

N69-35600# Technische Hochschule Carolo Wilhelmina, Brunswick (West Germany). Inst. fuer Kern- Und Radiochemie.

INVESTIGATION OF REACTOR FUEL MATERIALS AT HIGH TEMPERATURES [VERHALTEN VONKERNREAKTORBRENNSTOFFEN BEI HOEHEREN TEMPERATUREN]

R. Lindner Dec. 1968 14 p refs In GERMAN; ENGLISH summary

(BMwF-FBK-68-56) Avail: AEC Depository Libraries

Investigations of actinide diffusion were continued for base materials such as hyperstoichiometric uranium carbide (UC_{1+1}) and plutonium. The results obtained up to now show that the activation energy of diffusion in UC increases strongly with increasing carbon content. X-ray investigations of metallic Th-Pa alloys obtained by the Van Arkel process with Pa-contents ranging from 1 to 30% were executed. Complete solid solution behavior is observed at Pa-contents <10%. Pure protactinium monocarbide, PaC, was prepared for the first time and its lattice structure was determined. It is of the NaCl-type with $a_0 = 5.0608 \pm 0.0002$ Å. Running investigations of the pseudo-binary phase diagram UC/UO by high temperature X-ray diffractometry were continued. A new study was started concerning the development of a pyrochemical reprocessing procedure for irradiated thorium fuel using the salt transport process. Author (NSA)

N69-35607# International Centre for Theoretical Physics, Trieste (Italy).

GENERALIZED DIFFRACTION MODEL FOR ONE- AND TWO-NUCLEON TRANSFER REACTIONS

W. E. Frahn (Cape Town Univ.), and M. A. Sharaf (Cairo Univ.) Mar. 1969 28 p refs Submitted for publication

(IC-69-21) Avail: CFSTI

The amplitude for one- and two-nucleon transfer reactions in distorted-wave Born approximation is evaluated by means of a generalized diffraction method. In this method the distortion in the initial and final channels is described in terms of parametrized phase shifts for elastic scattering. The differential cross-sections are given by simple closed expressions which display the kinematic features characteristic of direct reactions between strongly absorbed particles. The results are illustrated by typical examples. Author (ESRO)

N69-35618# Cambridge Univ. (England). Dept. of Applied Mathematics and Theoretical Physics.

ELECTRON IMPACT EXCITATION OF POSITIVE IONS

A. Burgess, D. G. Hummer (Joint Inst. for Lab. Astrophys.), and J. A. Tully (Nice Obs.) [1969] 84 p refs Sponsored partly by Culham Lab. and ESRO

Avail: CFSTI

Non-relativistic Coulomb Born-Oppenheimer resonance matrices and cross sections are given for all transitions between the 1s, 2s and 2p states in He^+ and in hydrogen-like ions of large nuclear charge. From these results some cross sections for intercombination transitions in highly charged non-hydrogenic ions are estimated. Author (ESRO)

N69-35619# International Centre for Theoretical Physics, Trieste (Italy).

INFINITES OF NON-LINEAR AND VECTOR MESON LAGRANGIAN THEORIES

R. Delbourgo (Imp. Coll. of Sci. and Technol., London), Abdus Salam, and J. Strathdee Mar. 1969 45 p refs Submitted for publication

(IC-69-17) Avail: CFSTI

The unitarity and causality preserving technique for summing perturbation contributions introduced by Efimov and Fradkin is extended and applied to non-linear (chiral) type Lagrangian theories and also to theories of massive Yang-Mills and neutral pseudovector mesons. It is shown that the only likely infinities in these theories are those associated with self-mass and self-charge. The same conclusions appear to hold for weak interactions mediated by intermediate bosons. Crucial to the treatment of vector meson theories is the use of (purely self-interacting) unitarity-preserving Stückelberg-like auxiliary fields. ESRO

N69-35622# Rome Univ. (Italy). Ist. Di Fisica.

RIGOROUS DERIVATION OF PROJECTION FORMULAS FOR O(2,1)-INVARIANT OFF-SHELL FUNCTIONS

S. Ferrara and G. Mattioli 8 Jan. 1969 14 p refs *Its* Note Interna no. 201

(NP-17884) Avail: AEC Depository Libraries

Projection formulas, which allow one to perform the generalized Laplace transform for a class of O(2,1)-invariant offshell functions, are derived in a rigorous way. The usefulness of this transformation is shown for the physical case of spinless particles scattering described by iterated ladder graphs. Author (NSA)

N69-35623# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Experimentelle Kernphysik.

CALCULATION OF THE MASS VALUE FOR ATOMIC NUCLEI WITH A LESS THAN OR EQUAL TO 8 [BERECHUNG VON MASSENWERTEN FUER ATOMKERNE MIT A LESS THAN OR EQUAL TO 80]

H. Behrens and J. Jaenecke (Mich. Univ., Ann Arbor) Sep. 1968 53 p refs In GERMAN

(KFK-829) Avail: AEC Depository Libraries

A table of masses of proton and neutron rich nuclei with $A \leq 80$ is presented. For the calculation of the table a relation was used which makes it possible to estimate the excitation energies of isospin analog states. The excitation energies can be described approximately by a T dependence of the form $T(T + 1)$. The singularities of the calculation are described. Author (NSA)

N69-35629# Turin Univ. (Italy). Istituto di Fisica Generale.

PROPOSAL FOR MEASURING ENERGY SPECTRA OF MUONS AT 70 m.w.e. USING CERENKOV COUNTER AND IMAGE INTENSIFIER [PROSPOSTA DI MISURA DELLO SPETTRO D'ENERGIA DEI MUONI A 70 m.w.e. CON RIVELATORE CERENKOV E INTENSIFICATORE DI BRILLANZA]

L. Bergamasco, M. Dardo, and G. Marangoni [1969] 15 p refs In ITALIAN Sponsored by Consiglio Nazl. delle Ric.
Avail: CFSTI

Proposed measurements of the energy spectra of muons with given angles of incidence at depths of 70 to 90 m.w.e. using a Cerenkov counter and an image intensifier are discussed. It is hoped to obtain accurate velocity measurements by determining the angle of the Cerenkov cone and the coordinates of the centre of the light circle in the focal plane should indicate the directions of the incoming particles. ESRO

N69-35643*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
CORRELATION EFFECTS IN TWO-ELECTRON ATOMS [O KORRELYATSIONNYKH EFFEKTAKH V DVUKHELEKTRONNYKH ATOMAKH]
D. A. Kirzhnits Washington NASA Aug. 1969 9 p refs Transl. into ENGLISH from Opt. i Spektroskopiya (Moscow), v. 5, no. 5, 1958 p 485–489
(Contract NASw-1692)
(NASA-TT-F-12555) Avail: CFSTI CSCL 20H

The correction in the energy correlation of two-electron atoms, i.e., the difference between the precise energy value and the value obtained in approximation of the self-consistent field, are computed using the perturbation theory. The corrections were found to be independent of the charge from the Z nucleus, and the applicability of the method used in this work improves with increase in Z. The results agree with the data available for the case when Z is greater than or equal to 6. Author

N69-35668# Stanford Linear Accelerator Center, Calif.
ELASTIC p-He 4 BACKWARD SCATTERING AT 665 MeV PROTON ENERGY [UPRUGOE pHe 4 RASSEYANIE NAZAD PRI ENERGII PROTONOV 665 MeV]
V. I. Komarov et al Apr. 1969 16 p refs Transl. into ENGLISH of Russian report JINR-P1-3720
(SLAC-Trans-95; JINR-P1-3720) Avail: CFSTI

The differential cross section of 665-MeV proton elastic scattering by ^{4}He nuclei at an angle of 169° (cms) was measured by the scintillation counter method. The obtained value of (1.21 0.3) · 10^{-31} cm^2 $star.^{-1}$, corresponding to 9.5 f^{-1} momentum transfer is compared with the theoretical estimation of the probability of such scattering based on the idea of nuclear matter density fluctuations. Author (NSA)

N69-35676# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.
A GAS DISCHARGE ION SOURCE FOR AN ELECTROMAGNETIC SEPARATOR OPERATING ON-LINE WITH A HEAVY ION CYCLOTRON
Tarantin et al Jan. 1969 28 p refs Transl. into ENGLISH of Russian report JINR-P13-4061, 1968
(NP-tr-1781; JINR-P13-4061) Avail: CFSTI

The design and some operation characteristics of a gas discharge ion source for use with an electromagnetic mass separator operating on-line with a heavy ion cyclotron are presented. NSA

N69-35677# Oak Ridge National Lab., Tenn. Office of Language Services.
THE CALCULATION OF THE INELASTIC INTERACTION OF COSMIC NUCLEI
V. S. Barashenkov et al [1969] 4 p refs Transl. into ENGLISH of Russian report JINR-P2-3507
(ORNL-tr-1934; JINR-P2-3507) Avail: CFSTI

Deuteron–nucleus reactions were studied. Calculations were carried out using the Monte Carlo method within the framework of a cascade-evaporation model taking into account stripping and Coulombic and diffractive spallation. Some results are given. NSA

N69-35680# Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.
THEORY OF ANALOG RESONANCES
A. K. Kerman Mar. 1969 36 p refs Presented at the Conf. on Isobaric Spin, Pacific Grove, Calif.
(Contract AT(30-1)-2098)
(MIT-2098-528; CONF-690310-5) Avail: CFSTI

The use of the analog resonance phenomena to probe the parent wave functions and also to probe the final-state wave function is discussed. One can carry out this program to the extent that the matrix elements of the two-body Coulomb force are really very small compared to the matrix elements of the one-body average Coulomb field, and the coupling of the analog state to the continuum through the intermediary of the compound nucleus can be studied by a random-phase argument, or if not, can be studied by making some more precise statements about the compound nucleus modes themselves. Therefore the conclusion (always subject to further study of the small effects) is that one should be able to accurately determine spectroscopic factors (detailed wave functions in general) for analog states using a microscopic theory. This eliminates some of the over-simplifications of the macroscopic theories. But the data analysis should then always be given in terms of escape amplitudes and total widths, not partially theoretical quantities. Author (NSA)

N69-35691# Hahn-Meitner-Institut fur Kernforschung, Berlin (West Germany).
STRUCTURE ANALYSIS OF NUCLEAR PHYSICS EXPERIMENTS AS A BASIS FOR ON-LINE CONTROL BY A DIGITAL COMPUTER
L. Frevert Dec. 1968 60 p In GERMAN
(BMw-F-FBK-68-50) Avail: AEC Depository Libraries

The basic lines along which experiments of actual interest at the Nuclear Physics Department of the Hahn–Meitner–Institute for Nuclear Research, Berlin, are being run are described. The possibilities of improving these experiments by means of on-line data processing and on-line control by a digital computer are discussed. On the basic experimental design derived from such an analysis a proposal for a software system is being developed. Further work projected to be done in continuation of the structure analysis of nuclear physics experiments is outlined. Author (NSA)

N69-35692# Technische Hochschule Munchen (West Germany).
REPORT ON EXPERIMENTS Annual Report, 1967
Aug. 1968 170 p refs In GERMAN
(BMwF-FBK-68-39) Avail: AEC Depository Libraries

Results of the following experiments are reported: Coherent scattering length and free cross-section for slow neutrons, (n,γ) and (n,e⁻) spectra, (n,p), (n,α) and (n,2n) cross-sections, light emission after β-decay, nuclear resonance-fluorescence yields in solids, fatigue measurements in copper and steel, irradiation induced changes of electrical, mechanical and magnetic properties of metals at low temperatures, and small angle scattering of neutrons and X-rays. In addition we report on the construction of a time-of-flight neutron spectrometer and neutron guide tubes for production of polarized and extremely slow neutrons. Author (NSA)

N69-35693# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton. Rutherford High Energy Lab.
PROTON LINEAR ACCELERATOR (PLA) Progress Report, 1968
C. J. Batty, ed. Nov. 1968 166 p refs
(RHEL/R-170) Avail: CFSTI

An account is given of the Proton Linear Accelerator machine operation and development, including various improvements. Proton scattering studies are described, together with studies on proton induced reactions. The report also describes some theoretical studies; also experimental techniques, and health physics matters. An outstanding facility of the PLA is the polarized proton source; studies with this have included precision measurement of the angular distribution of polarization in elastic scattering. A technique was also developed for the study of elastic scattering of polarized protons at backward angles (up to 175°); results for carbon indicate that there is a large and rapid reversal of polarization (−70% +100%) in the region of 150° to 160°. Oxygen also shows the same effect, but not in quite as marked a manner. Reference is also made to the TRIUMF project, the aim of which is to build a 500 MeV variable energy cyclotron on the University of British Columbia campus. Author (NSA)

N69-35695# United Kingdom Atomic Energy Authority, Harwell (England).
AVERAGE FISSION CROSS SECTIONS AND RESONANCE INTEGRAL CONTRIBUTIONS BETWEEN 10 EV AND 20 KEV DEDUCED FROM SCISRS DATA TAPES
G. D. James and M. G. Schomberg Jan. 1969 12 p refs
(AERE-M-2157) Avail: CFSTI

Data tapes listing the experimental fission cross section data for ^{233}U, ^{235}U, ^{239}Pu, and ^{241}Pu below 35 keV from the SCISRS data file were obtained and used to determine the average fission cross section and resonance integral contribution over selected energy ranges from 10 eV to 20 keV. These results are presented in tabular form. It is noted that three of the data sets are discrepant. Author (NSA)

N69-35699# Council for Scientific and Industrial Research, Pretoria (South Africa). National Physical Research Lab.
EVAP: A COMPUTER PROGRAMME FOR THE CALCULATION OF ANGULAR MOMENTUM DISTRIBUTIONS IN NEUTRON-EVAPORATION REACTIONS
S. J. Mills Feb. 1968 36 p refs
(CSIR-282) Avail: AEC Depository Libraries

A statistical-model program for the calculation of the relative populations of angular momentum states populated in neutron-evaporation reactions is described. A FORTRAN 4(G) listing of the program is given in an appendix. Author (NSA)

N69-35701# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
MESON THEORY OF NUCLEAR FORCES
Pak Ben Gir 1969 11 p refs In RUSSIAN
(JINR-P4-4376) Avail: AEC Depository Libraries

Matrix elements for the spin-momentum term of the nucleon-nucleon potential for two-nucleon system states were obtained. In the one-boson-exchange model the connection between the nucleon-nucleon and nucleon-antinucleon interaction was considered for the cases of exchange of mesons having different symmetry. Author (NSA)

N69-35711# Technische Hochschule Munchen (West Germany). Teilinst. Maier-Leibnitz Im Physikdepartment.
ANNUAL REPORT, 1968 [JAHRESBERICHT, 1968]
Aug. 1968 257 p refs In GERMAN; ENGLISH summary
(BMWF-FBK-68-38) Avail: AEC Depository Libraries

In 1968 the following problems were investigated: investigation of the low energy (n,γ) radiation and of conversion electrons after neutron capture, investigation of the average number and energy of β-particles per nuclear fission, exact measurements of scattering lengths for slow neutrons at the gravity spectrometer in order to investigate the neutron-electron interactions, measurement of the slowing down of recoil atoms with the nuclear resonance fluorescence method, change of the properties of crystals by lattice imperfections induced by irradiation, investigation of imperfections and dislocations by scattering of subthermal neutrons, and construction of a totally reflecting guide tube. Author (NSA)

N69-35713# Brookhaven National Lab., Upton, N.Y. Physics Dept.
A GUIDED TOUR OF "A SUB 2"
Kwan Wu Lai 4 Apr. 1969 36 p Presented at the Amer. Phys. Soc. Meeting, New York, Feb. 1969 Supported by the AEC
(BNL-13561; Conf-690209-2) Avail: CFSTI

A survey is first given of early bubble chamber experiments where the $A_2(1300)$ was evidenced as one peak. Results of new developments from counter experiments, which showed the two peak structure of A_2, are reviewed. Some implications and experimental evidence of $J^P(A^1_2 - A^H_2)$ and $J^P(A^1_2 - A^H_2)$ are given. Suggestions for further experiments are made. NSA

N69-35717# Los Alamos Scientific Lab., N.Mex.
MEDIUM-ENERGY PHYSICS PROGRAM Quarterly Status Report for the Period Ending 31 Jan. 1969
6 Mar. 1969 48 p refs
(Contract W-7405-eng-36)
(LA-4118) Avail: CFSTI

The medium-energy physics program at LASL is described. Topics discussed include accelerator structures, rf power systems, accelerator control and instrumentation, accelerator physics, the experimental area, LAMPF scheduling and facility construction, and the pion production experiment. NSA

N69-35730# Aktiebolaget Atomenergi, Stockholm (Sweden).
THE APPLICATION OF THERMOLUMINESCENCE DOSIMETERS TO STUDIES OF RELEASED ACTIVITY DISTRIBUTIONS
B.-I. Rudén Jun. 1969 49 p refs
(AE-362) Avail: CFSTI

In this report the theoretical conditions necessary for the study of the behaviour of released activity by the use of $CaSO_4$:Mn thermoluminescence dosimeters are considered. A method is derived for calculating exposure distributions from drifting volume activity. One of the thirty experiments where Br 82 was released into water through a nozzle some metres above the bottom is described. The correlation between exposure distributions and concentration distributions is discussed. The advantages and disadvantages of the technique are compared with other methods. The method using exposure measurements for the study of active release in water has given satisfactory results in practice. A special advantage with this method is that the measurements can be made simultaneously at a large number of places and that integration is possible over sufficiently long periods of time. An experiment is described where A 41 was released in free air at a height of one meter above ground and the resulting exposure distribution was measured in a vertical plane at 100 and 250 meters distance by $CaSO_4$:Mn thermoluminescence dosimeters. An account is given of the possibility of using the beta emitting isotope Kr 85 instead of the gamma emitting A 41 for diffusion experiments in air. The results obtained

from some experiments are presented and discussed. The methods described here seem to be especially useful where calculations and other established methods are not possible to use e.g. where vegetation or building disturb the dispersion patterns. Author (ESRO)

N69-35739# European Organization for Nuclear Research, Geneva (Switzerland).

THE ANGULAR AND ENERGY DEPENDANCE OF THE EFFECTIVE CROSS SECTION FOR THE PHOTO PRODUCTION OF MESONS POSITIVE PION ON THE PROTONS IN THE RANGE OF ENERGY NEAR THE THRESHOLD [APPROXIMATION DE LA DEPENDANCE ANGULAIRE ET ENERGETIQUE DE LA SECTION EFFICACE DE PHOTOPRODUCTION DES MESONS POSITIVE PION SUR LES PROTONS DANS LA GAMME D'ENERGIE VOISINE DU SEUIL]

M. I. Adamovich et al Nov. 1968 39 p refs Transl. into FRENCH from AN SSSR, Moscow, Inst. Fiz. Preprint No. 40, 1968 In FRENCH Submitted for publication

(CERN-Trans-68-18) Avail: AEC Depository Libraries

The form of the energy dependence of the differential cross section for photoproduction of mesons ($\pi+$) was determined for seven angles θ in the center of mass system for an energy interval of photons between threshold and 200 MeV. Author (NSA)

N69-35757# International Centre for Theoretical Physics, Trieste (Italy).

CROSSING SYMMETRIC REGGE POLE MODEL FOR π-π SCATTERING

J. W. Moffat Jun. 1969 13 p refs Submitted for publication Supported in part by Can. Natl. Res. Council

(IC-69-42) Avail: CFSTI

An interference model of π-π scattering is constructed which possesses linearly rising trajectories, Regge behavior, resonances in all channels and is crossing symmetric. The model satisfies the Adler condition and predicts the Weinberg scattering lengths to within 10%. The calculated partial widths of the resonances associated with the leading trajectory are in reasonable agreement with experiment. Author (ESRO)

N69-35796# Rensselaer Polytechnic Inst., Troy, N.Y.

NEUTRON AND GAMMA RAY EMISSION FROM HIGHLY EXCITED STATES AND STATES WITH HIGH SPIN Annual Progress Report, 1 Jun. 1968 - 31 May 1969

Daniel Sperber Mar. 1969 51 p refs

(Contract AT(30-1)-1955)

(RPI-3947-2) Avail: CFSTI

Work performed at Rensselaer Polytechnic Institute during the period June 1, 1968, to May 31, 1969, is reported. Methods were developed for the calculation of excitation functions and spectra in (α,xn), (n,γ) and (p,γ) reactions. Also methods were constructed for the evaluation of isomer ratios in (n,xn) reactions. Calculations were performed for these reactions on several nuclei using the compound nucleus statistical model. NSA

N69-35797# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Angewandte Kernphysik.

THE INFLUENCE OF THE SHELL EFFECT ON THE KINETIC ENERGY AND THE EXCITATION ENERGY OF FISSION FRAGMENTS

F. Dickmann and K. Dietrich Sep. 1968 57 p refs

(KFK-835) Avail: AEC Depository Libraries

In order to derive the nuclear model for the fission point, the nucleus in the fission configuration is described by Nilsson potentials with pair force as residual interaction. In order to consider at the same time the saturation property of the nuclear matter, the shell model description according to the Strutinskii proposal is combined with the drop model. The model parameters are derived. The shell effects in the deformation energy of an isolated nucleus and with two nuclei at rest are calculated according to this model. The comparison with experimental results and other calculations gives satisfactory agreement. NSA

N69-35805# Hamburg Univ. (West Germany). Inst. fuer Experimentalphysik.

ANNUAL REPORT, 1967 [JARESBERICHT, 1967]

Feb. 1969 88 p refs In GERMAN; ENGLISH summary

(BMWF-FBK-69-4) Avail: AEC Depository Libraries

Research at Physikalisches Staatsinstitut - II. Institut für Experimentalphysik, Hamburg-Bahrenfeld, includes experimental and theoretical studies in the fields of nuclear and high energy physics. Concerning nuclear physics investigations, stress is laid mainly on nuclear spectroscopy and the study of reaction mechanism. These experiments are performed with a 3 MeV van de Graaff generator and by means of radioactive sources. High energy physics is investigated especially by analysis of photographs taken in the bubble chambers and by studies of production processes of elementary particles, both in connection with Deutsches Elektronen-Synchrotron (DESY). Author (NSA)

N69-35806# Technische Hochschule Carolo Wilhelmina, Brunswick (West Germany) Inst. A fuer Physik.

ANNUAL REPORT, 1967 [JAHRESBERICHT, 1967]

Feb. 1969 59 p refs In GERMAN; ENGLISH summary

(BMWF-FBK-69-5) Avail: AEC Depository Libraries

The Annual Report on Nuclear-Spectroscopic Investigations at the Institut A fuer Physik contains the following parts: Measurements with the Angular Correlation Apparatus: determination of E2/M1-mixing ratios of 2^+-2^+-transitions in ^{188}Os and in ^{58}Fe and ^{74}Ge in the presence of positrons. Lifetime Measurements with a Parallel-Plate-Avalanche Counter using the Converter Technique: Study to extend the range of application of the detector to include measurements on gamma-transitions with low conversion coefficients. Investigation of fast Photomultipliers: systematic study of the time resolution as a function of different parameters for the photomultipliers XP 1021 and RCA 8575. Measurements with an ironfree Beta-Spectrometer; determination of shape factors and endpoint energies of beta-transitions in Co60, Cs137, Cs134, Ce141, and Tm170. Author (NSA)

N69-35810# Idaho Nuclear Corp., Idaho Falls.

LOW ENERGY NEUTRON SPECTROSCOPY: MEASUREMENTS ON FISSILE NUCLIDES

M. S. Moore Jan. 1969 230 p refs Sponsored by AEC

(IN-1222) Avail: CFSTI

Fission of nuclei by resonance-energy neutrons is reviewed, through 1967, in the context of the channel theory of A. Bohr. Recent developments in the techniques of measuring cross sections of fissile nuclides are discussed. The data are examined in the light of giving evidence on spin dependencies of fission widths, mass distributions, fragment kinetic energies, and other fission properties. It is concluded that not only do these properties depend on spin, but they most probably also depend on the quantum characteristics of the fission saddle-point. Author (NSA

N69-35823# Centre National de la Recherche Scientifique, Bellevue (France). Laboratoire des Hautes Pressions.
CONTRIBUTION TO THE STUDY OF PERTURBATIONS IN THE VIBRATION-ROTATION SPECTRUM OF SOME DIATOMIC POLAR MOLECULES IN THE PRESENCE OF PRESSURIZED PERTURBING GASES [CONTRIBUTION A L'ETUDE DES PERTURBATIONS DU SPECTRE DE VIBRATION-ROTATION DE QUELQUES MOLECULES DIATOMIQUES POLAIRES SOUS L'ACTION DES GAZ ETRANGERS COMPRIMES]
Merle Robert Atwood (Ph.D. Thesis--Paris Univ.) 1968 124 p refs In FRENCH
Avail: CFSTI

The modifications introduced by the presence of a perturbing pressurized gas in a polar diatomic gas on the vibration-rotation spectrum are studied. It is shown that the brightness of the lines varies linearly with the density of the perturbing gas, and is, for a given mixture, a reverse function of the temperature, and a function of the spin. ESRO

N69-35828# Scottish Research Reactor Centre, East Kilbride.
REPORT ON SESSION 1967/1968
Feb. 1969 24 p refs
(SRRC-29/69)

Mass spectrometry is being used to study the effects of reactor radiation on organic materials at short times following radiolysis. Neutron diffraction equipment was modified to study phase changes in β-brass. Measurements of the beta energy released following fission of ^{235}U were completed. Errors arising from solubility losses and coprecipitation in the determination of fluorine by precipitation of CaF_2 were investigated using radiometric techniques. Approximately 20 consignments of 100 μCi of carrier-free ^{18}F were processed for use in tracer studies. Advances were made in resolution and performance of the Wien-type isotope separator. The decay properties of ^{55}Cr are being studied. Whole-body monitor calibration for body potassium measurements were studied. A double tracer of vitamin B_{12} absorption was developed. Development of the Isotope Geology Unit is reported. Reactor power increases and operation are discussed. NSA

N69-35837# Atomic Energy Establishment, Winfrith (England). General Reactor Physics Div.
LILLY: A COMPUTER CODE FOR CALCULATING AN INFERRED K-INFINITY FROM REACTION RATE MEASUREMENTS IN THERMAL REACTOR SYSTEMS
M. J. Hibberd and K. C. Kendall Aug. 1968 31 p ref
(AEEW-M-834) Avail: CFSTI; HMSO: 4s 6d

The program LILLY uses measured reaction rates to calculate corrections to a theoretical estimate of k-infinity. A cell calculation, giving an estimate of k-infinity, is followed by a fundamental mode leakage calculation which includes predictions of reaction rates in a critical spectrum. The differences between the computed and a set of measured reaction rates are then used to correct the theoretical value of k-inf to obtain a k-inf (reaction rate). The program was written specifically for the analysis of SGHW reactor experiments and uses a METHUSELAH group structure. Author (NSA)

N69-35838# Los Alamos Scientific Lab., N.Mex.
CALCULATION OF DELAYED NEUTRON MULTIPLICATION IN THIN SUBCRITICAL SYSTEMS
Clarence E. Lee and Christopher F. Masters [1968] 5 p refs Presented at the Intern. Conf. on the Constructive Uses of Atomic Energy, Washington, D.C.
(Contract W-7405-eng-36)
(LA-DC-9762) Avail: CFSTI

The DTF-IV transport code, modified to incorporate the Zero Prompt Lifetime Approximation, was used to calculate the delayed neutron multiplication in thin subcritical systems of ^{235}U and ^{238}U. NSA

N69-35852# Commissariat à l'Energie Atomique, Chusclan (France). Centre de Production de Plutonium de Marcoule.
STUDY OF THE DIFFUSION OF THE RADIOACTIVITY OF GLASSES AND BITMEN-COATINGS [ETUDE DE LA DIFFUSION DE LA RADIOACTIVITE DES VERRES ET ENROBES BITUMINEUX]
Jean Rodier, Maurice Marichal, Roland Benoit, Fernand Niezborala and Joël Le Bouhellec May 1969 31 p refs In FRENCH; ENGLISH summary
(CEA-R-3751) Avail: CFSTI

Glass pellets obtained from concentrated fission product solutions are subjected to the action of water, in conditions which are as close as possible to those of natural surroundings: still water, renewed water, running water. The retention by a given type of soil of the contamination in waters used for lixiviation is also studied. A comparison is made between various coating processes (bitumen or cement) and vitrification from the point of view of the behavior in the soil of residues thus treated. The overall results make it possible to choose between the different modes of storage as a function of the activity of the residuus to be processed. Author (ESRO)

N69-35853# Aktiebolaget Atomenergi, Stockholm (Sweden).
A HALF-LIFE MEASUREMENT OF THE 343.4 keV LEVEL IN LU175
M. Höjeberg and S. G. Malmskog May 1969 10 p refs Submitted for publication
(AE-361) Avail: CFSTI

Great theoretical interest has recently been shown in the asymptotically forbidden $5/2\ 5/2^+\ [402] \rightarrow 7/2\ 7/2^+\ [404]$ M1 -transitions in ^{181}Ta and ^{175}Lu. Half-lives of the $5/2\ 5/2^+\ [402]$ level in ^{175}Lu have been reported which differ by more than a factor of 10. Using an electron-electron coincidence spectrometer the half-life of this level has been re-measured and a value of (0.26 ± 0.02) nsec has been established. Author (ESRO)

N69-35856# Scientific Translation Service, Ann Arbor, Mich.
STATISTICAL CALCULATIONS OF INELASTIC COLLISIONS OF FAST PARTICLES WITH INTRANUCLEAR NUCLEONS
V. S. Bareshenkov et al 1968 26 p refs Transl. into ENGLISH from Russian Document Prepared for ORNL
(ORNL-TR-2123; JINR-P2-4068) Avail: CFSTI

A discussion is given of the manner in which an accurate satisfaction of the laws of conservation of momentum and energy in forming a model of an elementary event according to the Monte Carlo method can be ensured. It is shown that not only the mean values but also the distributions of the calculated quantities are found to be in close agreement with experiments. NSA

N69-35863# Atomics International, Canoga Park, Calif.
IMPROVED CALCULATION OF EFFECTIVE RESONANCE CROSS SECTIONS FOR FAST SPECTRUM ASSEMBLIES
J. M. Otter 5 Nov. 1968 12 p refs
(AI-AEC-Memo-12756) Avail: CFSTI

Modifications to the unresolved resonance subroutine in the TRIX code are described in both theoretical and practical detail. The effects dealt with include depletion of group fluxes by

resonance absorption, and the energy dependencies of the absorber potential scattering cross section and level spacing. Also included are the value of the radius of the centrifugal potential well, elastic scatter with change of neutron angular momentum, and Doppler-broadened self-shielded scattering cross sections. Calculations of infinitely dilute cross sections of ^{238}U are compared with optical model calculations and good agreement found. NSA

N69-35884# Max Planck-Institut fuer Kernphysik, Heidelberg (West Germany).
ANNUAL REPORT, 1967 [JAHRESBERICHT, 1967]
Nov. 1968 212 p refs In GERMAN; ENGLISH summary
(BMWF-FBK-68-51) Avail: AEC Depository Libraries

The report contains the following parts: Annual Report of the Tandem Laboratory, Annual Report of the Cyclotron Laboratory, Annual Report of the Nuclear Spectroscopy Group, Annual Report of the external guest groups of the MPI, and List of publications 1967. Period covered by the report is: Jan. 1st – Dec. 31st, 1967. Author (NSA)

N69-35897# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
CONTRIBUTION TO ACTIVATION ANALYSIS WITH 14 MeV NEUTRONS FOR RADIOELEMENTS HAVING A HALF LIFE LESS THAN ONE SECOND [CONTRIBUTION A L'ANALYSE PAR ACTIVATION AU MOYEN DE NEUTRONS DE 14 MeV DANS LE CAS DE RADIOELEMENTS DE PERIODES INFERIEURES A UNE SECONDE]
Andrzej Golanski (Ph.D. Thesis) May 1969 108 p refs In FRENCH; ENGLISH summary Sponsored jointly by Assoc. Organ. Stages en France and Joliot-Curie Found.
(CEA-R-3694) Avail: CFSTI

The particular problems arising from the use in activation analysis of radioelements having a half-life less than one second have been studied in the case where no sample transfer occurs e.g. cyclic irradiation and counting, detector blocking system, neutron monitor, background noise. Fifteen nuclear reactions were studied in order to consider using them in activation analysis with pulses of 14 MeV neutrons. The half-lives of the radioisotopes produced varied from 0.5 to 870 milliseconds. The results obtained with a 14 MeV low flux neutron generator are discussed from the point of view of sensitivity and accuracy. Author (ESRO)

N69-35908# Stichting Voor Fundamenteel Onderzoek Der Materie, Utrecht (Netherlands). Inst. Voor Kernphysisch Onderzoek
ANNUAL REPORT, 1967 [JAAVERSLAG, 1967]
1967 183 p refs In DUTCH
(NP-17845) Avail: AEC Depository Libraries

The structure and financing of the Foundation for Fundamental Research on Matter and the Foundation for Nuclear Physics Research are described. The research on nuclear physics, mass separation and analysis, metals, molecular physics, solid state physics, thermonuclear reactions, and high energy physics is briefly outlined. Bibliographic data are given for the published works in each division. NSA

N69-35910# University Coll., London (England). Dept. of Physics.
RESONANCES IN COLLISION STRENGTHS FOR EXCITATION OF [O II] AND [O III]
W. Eissner, P. de A. P. Martins, H. Nussbaumer, Hannelore E. Seraph, and M. J. Seaton Apr. 1969 16 p refs Sponsored by Culham Lab., Sci. Res. Council, Deut. Forsch. Gemeinschaft, Roy. Soc., and ESRO
Avail: CFSTI

The collision strength for the transition 0^+ $2s^22p^3$ $^2D_{3/2}$ – $^2D_{5/2}$ has a complicated resonance structure at energies below the threshold for excitation of 0^+, $2s^22p^3$ $2p$. The collision strengths for the transitions due to collisional coupling between the configurations $2s^22p^2$ and $2s2p^3$. The results obtained in recent calculations are presented in a form convenient for astrophysical applications. The resonances do not produce any large changes in the intensity ratios, [O II] (λ_3729)/(λ3726) and [O III] (λ4959 + λ5007)/(λ4363), as functions of electron temperature and electron density. Author (ESRO)

N69-35912# International Centre for Theoretical Physics, Trieste (Italy).
ROTONS OR TRANSITION OPERATORS COUPLING THE STATES IN NUCLEAR ROTATIONAL BANDS
I. N. Mikhailov and E. Nadjakov (Bulg. Acad. of Sci.) Mar. 1969 15 p refs
(IC/69/20) Avail: CFSTI

The microscopic theory of nuclear rotation is formulated in analogy with the random phase approximation. Properties of operators transforming states in a rotational band into each other are discussed. Relations between the density matrix of a rotating nucleus and collective coordinates are established. Author (ESRO)

N69-35920# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
TABLES OF CHARGED PARTICLE ENERGIES VERSUS MAGNETIC FIELD STRENGTH × ORBIT RADIUS (Bρ) FOR A = 1 TO 7 (100 < (Bρ) < 1200 kG. cm)
Louis Bianchi Apr. 1969 88 p refs In FRENCH; ENGLISH summary
(CEA-R-3768) Avail: CFSTI

A table of charged particle energies versus magnetic field strength x orbit radius (Bρ) is presented. Author (ESRO)

N69-35921# International Centre for Theoretical Physics, Trieste (Italy).
A DOUBLE-SCATTERING MODEL FOR THE Li-6 (O-16, d) Ne-20 REACTION
II.-T. Cheon and H. M. Sen Gupta Mar. 1969 16 p refs Submitted for publication
(IC/69/18) Avail: CFSTI

A double-scattering model within the framework of the cluster model in nuclei is proposed for the (O-16, d) reaction in Li-6; it is thereby possible to account for the forward peak in experimental angular distribution. All the interactions in the formalism were considered to be of the harmonic oscillator type and for simplicity the problem has been treated in terms of the plane wave Born approximation. Author (ESRO)

N69-35928# Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.
SOME ASPECTS OF PRACTICAL APPLICATIONS OF MOESSBAUER EFFECT [MATERIALY SEMINARIUM POSWIECONEGO PRAKTYCZNYM ZASTOSOWANIOM EFEKTU MOESSBAUERA] Seminar Proceedings

Jozef Bara, ed. 1968 107 p refs In POLISH; ENGLISH summary Conf. held in Cracow, Apr. 1967 Prepared jointly by Polish Acad. of Sci. and Jagellonian Univ.
(INP-571/PL) Avail: AEC Depository Libraries

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7. POSSIBILITIES FOR APPLICATION OF MOESSBAUER EFFECT IN MINING, FOUNDRIES AND METALLURGY J. Sawicki (Jagellonian Univ.) p 64–70 refs (See N69-35933 20-24)

8. SUPPLEMENT. MOESSBAUER EFFECT AND ITS POSSIBILITIES FOR PRACTICAL APPLICATIONS J. Bara (Jagellonian Univ.) 38 p refs (See N69-35934 20-24)

N69-35927# Jagellonian Univ., Cracow (Poland). Inst. of Physics.
INFLUENCE OF SPIN DYNAMIC FLUCTUATIONS ON MOESSBAUER EFFECT [WPLYW FLUKTUACJI USTAWIENIA SPINOW ATOMOWYCH NA WIDMA MOESSBAUEROWSKIE]
Jozef Bara *In* Polish Acad. of Sci. Some Aspects of Pract. Appl. of Moessbauer Effect 1968 p 1–9 refs In POLISH (See N69-35926 20-24)
Avail: AEC Depository Libraries

The nuclear spin and the energy levels of the supersensitive reaction occurring between the magnetic moment of the nucleus and the magnetic moment of the atom or ion are discussed. The Moessbauer effect of the nuclear absorption of gamma rays permits the direct observation of the supersensitive reaction of the nucleus with the atomic shell. Experiments were carried out with coincidences in which time-dependent effects caused by supersensitive reactions were observed. Application of the Moessbauer method is described for the investigation of the temporary changes in supersensitive reactions when these changes are slow compared with the Larmor precession of nuclear spin. The Moessbauer effect depends on the time of the spin relaxation and the spin dynamic fluctuations. Transl. by K.W.

N69-35928# Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.
APPLICATION OF MOESSBAUER EFFECT IN STRUCTURAL CHEMISTRY [ZASTOSOWANIA EFEKTU MOESSBAUERA W CHEMII STRUKTURALNEJ]
Barbara Sawicka *In its* Some Aspects of Pract. Appl. of Moessbauer Effect 1968 p 10–24 refs In POLISH (See N69-35926 20-24)
Avail: AEC Depository Libraries

Measuring methods and results are presented for isomeric disperion and quadrupole diffraction of Moessbauer spectra obtained in experiments with iron compounds. The energy width of the Moessbauer line is small when compared with the line width of low-energy nuclear reactions within the atom. The exceptional energy resolution of the non-recoil method of resonant absorption permits the determination of small changes in the nucleus caused by such factors as atomic displacement in molecules or the lattice or by the reaction of the nucleus within the shell structure. The Moessbauer method was found to provide valuable information on the structure of solids and helps in the parametric definition of surface properties, line widths, energetic displacement, quadrupole fission, the Zeeman effect, and lattice dynamics. Transl. by K.W.

N69-35929# Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.
APPLICATION OF MOESSBAUER EFFECT IN MAGNETISM [ZASTOSOWANIE EFEKTU MOESSBAUERA W MAGNETYZMIE]
Dominik S. Kulgawczuk *In its* Some Aspects of Pract. Appl. of Moessbauer Effect 1968 p 25–38 refs In POLISH (See N69-35926 20-24)
Avail: AEC Depository Libraries

The usefulness of the Moessbauer effect in studying the behavior of atomic nuclei in relation to electrons and the crystal lattice is examined based chiefly on the work of other investigators. Applications in the study of magnetic properties of semiconductors, metals, alloys, and inter-metallic compounds are discussed. The measurements that are discussed include changes in polarization, temperature dependence of magnetic flux density, magnetic fields in nonmetallic compounds, spin polarization of electron pairs, orbital magnetic moments, and dipole reactions. Transl. by K.W.

N69-35930# Jagellonian Univ., Cracow (Poland). Inst. of Physics.
APPLICATION OF MOESSBAUER EFFECT IN BIOLOGY. APPLICATION OF MOESSBAUER EFFECT IN MEASUREMENT OF LOW TEMPERATURES. APPLICATION OF MOESSBAUER EFFECT IN MEASUREMENT OF HIGH PRESSURES [ZASTOSOWANIE EFEKTU MOESSBAUERA W BIOLOGII. ZASTOSOWANIE EFEKTU MOESSBAUERA DO POMIARU NISKICH TEMPERATUR. ZASTOSOWANIE EFEKTU MOESSBAUERA DO POMIARU WYSOKICH CISNIEN]
Kyzysztof Tomala *In* Polish Acad. of Sci. Some Aspects of Pract. Appl. of Moessbauer Effect 1968 p 39–52 refs In POLISH (See N69-35926 20-24)
Avail: AEC Depository Libraries

The applications in biology are concerned mainly with the identification of chemical elements, and here the emphasis is again on the spectral determination of iron in hemoglobin, hemin, proteins, nucleic acids, and cytochromes. Studies of iron contents in living hydrogenomonas, the iron metabolism in other organisms, and a biomechanical measurement of acoustic vibrations in the ear's tympanic membrane are also mentioned. The low-temperature measurements make use of the gamma line sensitivity and polarization of nuclei in connection with the Moessbauer effect. Temperature measurements with activated Co 57 isotope in liquid helium and the determination of resonant absorption spectra in iron using a cobalt source are described. High-pressure measurements by means of the Moessbauer method involved experiments with Fe 57 and the changes in electron density and atomic structure caused by the pressure. Transl. by K.W.

N69-35931# Jagellonian Univ., Cracow (Poland). Inst. of Physics.
THE USE OF MOESSBAUER EFFECT FOR MEASUREMENTS OF RELATIVE VELOCITY AND AMPLITUDE OF

VIBRATIONAL OSCILLATION [WYKORZYSTANIE EFEKTU MOESSBAUERA DO POMIARU PREDKOSCI RUCHU WZGLEDNEGO I AMPLITUD DRGAN WIBRACYJNYCH]

Tadeusz Matlak *In* Polish Acad. of Sci. Some Aspects of Pract. Appl. of Moessbauer Effect 1968 p 53–59 refs In POLISH (See N69-35926 20-24)

Avail: AEC Depository Libraries

The technological applications of the Moessbauer effect for determining displacement and acceleration in closed systems are emphasized. Isotopes emitting gamma rays were used to measure the Doppler shift and resonant nuclear absorption. Experiments are described in which a Fe 57 isotope emitting 14.4-keV gamma rays was used for registering the relative velocity of two objects. Problems in the application are briefly reviewed. Transl. by K.W.

N69-35932# Jagellonian Univ., Cracow (Poland). Inst. of Physics.

INVESTIGATION OF HEAT TREATMENT AND MECHANICAL DEFORMATION OF MATERIALS [BADANIE CIEPLNEJ I MECHANICZNEJ OBROBKI MATERIALOW]

Krzysztof Krolas *In* Polish Acad. of Sci. Some Aspects of Pract. Appl. of Moessbauer Effect 1968 p 60–63 In POLISH (See N69-35926 20-24)

Avail: AEC Depository Libraries

The use of nuclear resonant absorption of gamma rays for determining chemical and structural changes in crystal phases caused by heat treatment and mechanical deformations is considered. Several experiments are discussed in which the speed of oxidation was determined for metallic compounds under varying conditions of temperature, humidity, and chemical influences. The effects of combined exposure to high temperatures and to an external magnetic field on magnetic properties were also observed. Transl. by K.W.

N69-35933# Jagellonian Univ., Cracow (Poland). Inst. of Physics.

POSSIBILITIES FOR APPLICATION OF MOESSBAUER EFFECT IN MINING, FOUNDRIES AND METALLURGY [MOZLIWOSCI ZASTOSOWAN EFEKTU MOESSBAUERA W KOPALNICTWIE HUTNICTWIE I METALURGII]

Jerzy Sawicki *In* Polish Acad. of Sci. Some Aspects of Pract. Appl. of Moessbauer Effect 1968 p 64–70 refs In POLISH (See N69-35926 20-24)

Avail: AEC Depository Libraries

Methods for determining the composition of iron, tin, their alloys, and their contents in minerals are considered for applications in metallurgy. This includes the use of the Moessbauer effect for observing the progression of reduction reactions during the smelting of metal-containing minerals and the determination of sulfur and carbon contents. Conversely, these methods are also applicable for analyzing the composition of slags. Transl. by K.W.

N69-35934# Jagellonian Univ., Cracow (Poland). Inst. of Physics.

SUPPLEMENT. MOESSBAUER EFFECT AND ITS POSSIBILITIES FOR PRACTICAL APPLICATIONS [DODATEK. ZJAWISKO MOESSBAUERA I MOZLIWOSCI JEGO PRAKTYCZNEGO WYKORZYSTANIA]

Josef Bara *In* Polish Acad. of Sci. Some Aspects of Pract. Appl. of Moessbauer Effect 1968 38 p refs In POLISH Presented at the Symp. on Radionuclides and Nuclear Science, Spala, Poland, 8–10 May 1967 (See N69-35926 20-24)

Avail: AEC Depository Libraries

Theoretical principles of the Moessbauer effect are briefly reviewed. Decay schemes of Fe 57 and Co 57 are discussed in connection with applications of the Moessbauer effect in technology. Temperature-caused shifts in the line spectra are examined. Specific applications are discussed in nuclear physics, solid-state physics, and chemistry. The properties of a number of other isotopes are tabulated for possible use with the Moessbauer method. Transl. by K.W.

N69-35964# Gulf General Atomic, San Diego, Calif.

NEUTRON CROSS-SECTION MEASUREMENTS Summary Report, 1 Mar. 1968–28 Feb. 1969

M. P. Fricke, W. M. Lopez, D. J. Costello, S. J. Friesenhahn, and A. D. Carlson 27 Mar. 1969 67 p refs

(Contract AT(04-3)-167)

(GA-9275) Avail: CFSTI

Work performed on neutron corss sections at Gulf General ATomic from March 1, 1968 to Feb. 28, 1969 is described. The work included gadolinium and zirconium resonance parameters, gadolinium and gold capture cross sections, and the $^{3}He(n,p)T$ reaction cross section. General experimental improvements and work planned for the future are also described. NSA

N69-35970# Academia R. P. R., Bucharest. Inst. de Fizica Atomica.

FAST ELECTRONICS FOR FAST NEUTRON SPECTROMETRY FOR THE CYCLOTRON [ELECTRONIQUE RAPIDE POUR LA SPECTROMETRIE DES NEUTRONS RAPIDES AU cyclotron]

M. Molea 1968 23 p In FRENCH

(IFA-CRD-37) Avail: AEC Depository Libraries

Experiments are described which allow one to measure the angular distributions of spectra of the emerging particles (protons, alpha particles, or neutrons) and of the correlations $p\gamma$, α_p, and $n\gamma$ for the polarization of protons, alpha particles, and neutrons. For fast neutrons, time-of-flight spectrometers with coincidence circuits were constructed. NSA

N69-35971# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.

THE THREE-BODY PROBLEM WITH THE POTENTIAL OF RECTANGULAR FORM (SHAPE)

V. F. Kharchenko and S. A. Storozhenko 1969 12 p refs In RUSSIAN

(IFT-69-19) Avail: AEC Depository Libraries

A consideration of the three-nucleon problem, based on the method of separable expansion of the two-particle t-matrix (the Hilbert–Schmidt expansion), is carried out. The treatment is performed for the case of the intraparticle interaction being characterized by a central potential of the rectangular form. The binding energy of the triton and the scattering lengths of the neutron on the deuteron are calculated. Author (NSA)

N69-35972# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.

GROUND-STATE WAVE FUNCTION IN THE METHOD OF STRONG COUPLING

V. Ya. Antonchenko and I. V. Simenog 1969 20 p refs In RUSSIAN

(ITF-69-10) Avail: AEC Depository Libraries

A suggestion of improving the evaluation of the quadratic mean radius by taking into account the asymptotic properties of the wave function is considered. The mentioned above evaluation in approximation of two-particle strong coupling is dissatisfactory. The approximated wave function as well as form factors of ch^{-2} and e$^{-x^2}$ potentials are analyzed. Author (NSA)

N69-35991# Oxford Univ. (England). Dept. of Engineering Science.
MEASUREMENTS OF VERY SMALL ANGLE SCATTERING OF MEDIUM ENERGY ELECTRONS IN GASES
R. G. Lord 1969 32 p refs
(Contract B-SR-1898)
(REPT-1-075-69) Avail: CFSTI

The total scattering cross sections $\sigma(0)$ of helium, argon and nitrogen for 20kV selectrons have been measured in the angular range 06 x 103 rad. The results are compared with theoretical cross sections based on Hartree and Hartree-Fock atomic models. Agreement is found to be quite good in the case of helium but for the other two gases the measured cross sections are smaller than predicted. The effect of plural scattering is discussed.
Author (ESRO)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N69-34612*# National Aeronautics and Space Administration, Washington, D.C.
THE NONLINEAR THEORY OF DAMPING OF ELECTROMAGNETIC WAVES IN A PLASMA
N. S. Yerkhin et al Aug. 1969 10 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Techn. Fiz. (Moscow), no. 5, 1968 p 11–17
(NASA-TT-F-12372) Avail: CFSTI CSCL 20I

The article examines the absorption of a circularly polarized electromagnetic wave that is being propagated in a plasma along a magnetic field. Elliptic functions are used to solve the exact equations of motion of the particles in the resonance region. It is shown that the nonlinear decrement of the damping has an oscillatory nature. As $t \to 0$ it approaches zero, provided there are no collisions. A study is made of the influence of collisions on the absorption of the wave. It is shown that the decrement in the damping when collisions are taken into account depends on the amplitude of the wave.
Author

N69-34661# Illinois Univ., Urbana. Dept. of Electrical Engineering.
TWELFTH AFOSR CONTRACTORS' MEETING ON PHYSICAL ENERGETICS. SUMMARIES OF RESEARCH
Interim Report
May 1969 41 p refs
(Grants AF-AFOSR-1584-68; AF-AFOSR-1508-68)
(AD-688622; AFOSR-69-1387TR) Avail: CFSTI CSCL 20/9

The report contains abstracts of research summary presentations given at the subject meeting held 6-8 May 1969. Subjects reported include plasma diagnostics, magnetohydrodynamics acceleration and power generation. High temperature plasma production and containment related to controlled fusion, and charged particle accelerators related to physical energetics processes in energy and power sources and conversion.
TAB

N69-34743*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
EXCITATION OF A GYROTROPIC PLASMA WAVEGUIDE [VOZBUZHDENIYE GIROTROPNOGO PLAZMENNOGO VOLNOVODA]
V. A. Buts Washington NASA Aug. 1969 7 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 14, no. 2, p 270–275
(Contract NASw-1692)
(NASA-TT-F-12398) Avail: CFTI CSCL 20I

The problem is considered of exciting the plane plasma layer placed in the external magnetic field H_0 magnetic field H_0 which is perpendicular to the wave vector K of the excitation wave. The problem is shown to be reduced to the scalar boundary conjugate problem for the analytical functions with the index equal to zero. The simplest cases of analytical solution of the problem are considered.
Author

N69-34897*# Northwestern Univ., Evanston, Ill.
EXPERIMENTAL INVESTIGATION OF MAGNETOAERODYNAMIC FLOW AROUND BLUNT BODIES
S. Kranc, M. C. Yuen, and A. B. Cambel Washington NASA Aug. 1969 158 p refs
(Grant NsG-547)
(NASA-CR-1393) Avail: CFSTI CSCL 20I

The drag on a blunt body with a self-contained electromagnet was measured with the body placed in a low density argon plasma stream. Tests were conducted in a steady flow of plasma produced in a direct current arc and expanded to supersonic speeds. Measurements were restricted to one flow condition and the influence of viscosity and the Hall effect were both considered. From experimental measurements of the total drag on the body, the Lorentz force on the magnet and the pressure force on the body, the viscous forces on the body were deduced and empirical relations for the data were generated. The flow field around the body was investigated spectroscopically, and the predicted increase in shock stand-off distance observed photographically. Spectroscopic measurements showed that the electrons in the plasma were out of thermal equilibrium in the plasma and that the flow was essentially nonreacting.
Author

N69-34952*# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
QUASI-STEADY PLASMA ACCELERATION
Kenn E. Clark (Ph.D. Thesis) May 1969 181 p refs
(Grant NGL-31-001-005)
(NASA-CR-104138; Rept-859) Avail: CFSTI CSCL 20I

A steady state acceleration phase has been shown to occur in a coaxial electrode geometry during the synchronized application of tailored pulses of mass flow and current. This diffuse discharge form, characterized by a stabilized current distribution, constant voltage and current, and a steady argon mass flow rate of up to 50 g/sec, is of considerable interest as both a pulsed thruster and as a simulator of the self field magnetoplasmadynamic arcjet over a power range from 100 kW to 100 MW. Terminal voltage measurements, taken over a wide range of power and mass flow rate, are sufficiently precise to allow discrimination among several theoretical models of the acceleration process Kerr cell photographs and experimental maps of the current distribution in the exhaust plume and interelectrode region clearly show the rapid transition to this steady configuration, as well as characteristic arc behavior for mass starvation and mass overfeed.
Author

N69-34953*# Volt Information Sciences, Inc., Washington, D.C.
SOLUTION OF ONE CLASS OF MAGNETOHYDRODYNAMIC EQUATIONS WITH MAGNETIC FIELD AMPLIFICATION
A. V. Getling Greenbelt, Md. NASA Goddard Space Flight Center 25 Aug. 1969 9 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Fiz. (USSR), v. 187, no. 2, 1969 p 301–304
(Contract NAS5-12487)
(NASA-CR-104134; ST-MHD-SP-10860) Avail: CFSTI CSCL 20I

A dynamo theory, approximating a model oscillating hydrodynamic dynamo, for use in solar physics is discussed. The magnetohydrodynamic configurations of a convective cell under the influence of Coriolis forces are also investigated, and the solution for a simple magnetohydrodynamic equation is presented. The importance of this equation lies in its application to many similar magnetic velocity fields which, in turn, have other important applications. Author

N69-34969# Michigan Univ., Ann Arbor. Office of Research Administration.

SPECTROGRAPHIC STUDIES AT EXTREMELY HIGH TEMPERATURES: Terminal Report

R. H. Kadlec, F. E. Carleton, J. R. Gwozdz, S. W. Churchill, and G. J. Quarderer Jan. 1969 13 p

(Grant NSF GK-632)

Avail: Issuing Activity

To determine velocity profiles in a high temperature plasma jet, both experimental and theoretical work was carried out. The goal of the work was to establish general flow patterns as a function of operating variables, measure velocities in the jets, and compare the experimental data with cold flow profiles to determine effects of arc heating and extreme temperature. The photochemical kinetics of the chlorination of sulfur dioxide was determined using the plasma arc light source. The operation of this source was investigated, along with the use of light-absorbing dyes for wavelength selection. The studied parameters of the light source included argon flow rate and power input. The spectral output was determined. The following kinetic variables were studied: reaction temperature and pressure, flow rate, feed composition, and wavelength of exposure. The general flow patterns in an arc jet were determined as a function of operating conditions. A method for converting impact pressures to velocities for high temperature flows was established and verified. Author

N69-35023# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A TURBULENT MHD BOUNDARY LAYER IN A TRANSVERSE MAGNETIC FIELD

I. P. Ginzburg et al 19 Feb. 1969 20 p refs Transl. into ENGLISH from Uch. Zap. Leningr. Univ. (Leningrad), no. 338, 1968 p 59–74

(AD-687537; FTD-HT-23-69) Avail: CFSTI CSCL 20/9

The turbulent boundary layer of an MHD-flow over a flat plate is analyzed. The applied magnetic field is assumed to be transverse to the flow, with all induced effects neglected. The shear stress and the flow enthalpy are expressed as quadratic profiles of the boundary layer coordinate and velocity respectively. Author (TAB)

N69-35036# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

SOME CONSEQUENCES OF ROTATION IN THETA-PINCH-GENERATED PLASMA CONFINED BY A LONGITUDINAL MAGNETIC FIELD

Howard M. Stainer Mar. 1969 71 p refs

(NOw-62-0604-c)

(AD-688442; APL-TG-1059) Avail: CFSTI CSCL 20/9

A theoretical study was made of the characteristics of structured plasma puffs produced in a two-coil theta-pinch gun. The puffs are fired into a drift tube containing a longitudinal magnetic field, and their subsequent behavior is analyzed. Electron-electron and ion-ion collision times are short enough so that scalar pressures ($P = nkT$) can be used. Ion-electron collision times, however, are of the duration of the experiment or longer, allowing the use of two-fluid moment equations. An idealized model for the plasma puffs is proposed in which the ion fluid rotates as a rigid body in one direction about the longitudinal axis, and the electron fluid rotates in the opposite direction. This high-Beta model yields self-consistent equilibrium density and magnetic field profiles, stemming from a balance among thermal, magnetic, centrifugal, and electrostatic forces, that are compatible with observation. It is shown that double magnetic pick-up loop signals can be analyzed to ascertain the temperature, peak density, angular momentum, etc., of the plasma as it travels down the tube, and a sample calculation is presented to indicate the probable evolution of a typical puff. Thus, the model provides a self-consistent high-Beta approach to the problem of plasma and magnetic-field interaction. Author (TAB)

N69-35134# Oxford Univ. (England). Dept. of Engineering Science.

SCATTERING OF MICROWAVES BY AN OSCILLATING PLASMA IN A COAXIAL WAVEGUIDE

D. A. Fraser Dec. 1968 15 p refs

(REPT-1-071-68) Avail: CFSTI

A thermally generated cesium plasma occupying the annular space between the inner and outer conductors of a hot coaxial waveguide is investigated, in particular the scattering of a signal in the TEM mode by self induced ion oscillations in the plasma. ESRO

N69-35179# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.

LAMINAR COLLISIONFREE ELECTROSTATIC SHOCKS AND SHEATHS

Hans Persson Apr. 1969 50 p refs

(Rept-69-05) Avail: CFSTI

Special Bernstein-Greene-Kruskal solutions of the time-independent, one-dimensional, coupled Vlasov-Poisson equations are studied. The electrostatic potential is assumed to vary monotonically between two different, constant levels, and the ion and electron velocity distributions consistent with this potential are analyzed. The charge neutrality, over-all pressure balance, and space charge, (internal pressure balance), conditions impose conditions of Mach number type on the collisionfree particle distributions. In particular, the Bohm criterion for wall sheaths is generalized, and is found to apply in all cases, when there are not sufficient particles of a given species reflected against the potential structure. This structure can be considered as the result of a balance between thermal-like particles, having a negative derivative of the density with respect to the potential energy, and beam-like particles, having a positive derivative. Earlier work by Montgomery and Joyce is discussed, and it is shown that the Bohm criterion defines a critical lower Mach number for the shock studied by these authors. Another, simplified shock model, with equal ion and electron temperatures, and ion reflexions against the structure is studied, as well as a couple of simple sheath models. At least in the simplified shock example chosen, laminar solutions exist only for a limited band of Mach numbers, in agreement with fluid shock results. The application of the theory to practical problems, its relationship to non-monotonic shocks, turbulent shocks, and fluid shocks is discussed, as well as some general questions concerning particle energy and potential differences in plasma. Author (ESRO)

N69-35224# Forsvarets Forskningsanstalt, Stockholm (Sweden).

ELECTRICAL POWER PRODUCTION BY MEANS OF MHD, PRESENT SITUATION AND FUTURE PROSPECTS [ELKRAFTPRODUKTION GENOM MHD, NUVARANDE LAEGE OCH FRAMTIDSUTSIKTER]

E. Witalis Nov. 1967 14 p In SWEDISH
(FOA-4-C-4325-55) Avail: CFSTI

The research during recent years on magnetohydrodynamic energy conversion for commercial electric power production is briefly reviewed. Power requirements, costs, and efficiency of MHD generators are compared with conventional power generating systems. Experimental open-loop MHD generators, the closed-loop system, gas transport, and future potentials are discussed in somewhat more detail. Potential applications on ships, in aircraft, and in spacecraft are also briefly considered. Transl. by K.W.

N69-35280# Army Foreign Science and Technology Center, Washington, D.C.
MAGNETIC SYSTEMS USING STEEL FOR MAGNETOHYDRODYNAMIC GENERATORS
O. B. Bull 17 Apr. 1969 17 p ref Transl. into ENGLISH from Iz. Vyssh. Ucheb. Zaved., Elektromekhan. (Novocherkassk), no. 12, 1967 p 1330–1340
(AD-688393; FSTC-HT-23-568-68) Avail: CFSTI CSCL 20/9

Several designs for magnetic systems which can be employed in a magnetohydrodynamic generator, used to convert heat energy directly into electrical energy are analyzed. A design method is described for an annular magnetic system, the results of calculations are shown, and the system is compared in its basic parameters with a rectilinear magnetic system intended for a magnetohydrodynamic generator of the same power. Author (TAB)

N69-35297# Los Alamos Scientific Lab., N.Mex.
FREE-BOUNDARY SOLUTIONS FOR HIGH-BETA STELLARATORS OF LARGE ASPECT RATIO
F. L. Ribe Jan. 1969 20 p refs
(Contract W-7405-eng-36)
(LA-4098) Avail: CFSTI

Blank, Grad, and Weitzner recently obtained a solution for the equilibrium of a high- β plasma with a sharp boundary in a toroidal stellarator configuration of slight major curvature. This report summarizes the detailed expansion calculations using their "Scyllac" ordering and presents results in graphs suitable for the design of Scyllac experiments. A new result is presented which gives a nonshifted equilibrium when stellarator fields of order 1 and $l \pm 1$ are applied simultaneously. Comparison is made with a previous result using the "stellarator" ordering. In this case a critical beta appears, below which the lateral shift of the plasma column is outward for a single l value and above which it is inward, as in the present third-order Scyllac expansion. Curves of critical β are given for a sharp-boundaried plasma. The special case of $l = 1$ and long repetition period $2\pi/h$ of the stellarator field is of particular interest, since the lateral-displacement instability ($m = 1$, $k = 0$) is very weak. Image currents in the wall are effective in this case and can produce stability. The longitudinal current necessary to stabilize the lateral-displacement mode is also calculated for this case. Author (NSA)

N69-35336# Stichting Voor Fundamenteel Onderzoek Der Materie, Jutphaas (Netherlands). Inst. Voor Plasma-Fysica.
MAGNETOHYDRODYNAMIC STABILITY OF THE TOROIDAL SCREW PINCH
R. F. de Vries (Ph.D. Thesis - Utrecht Univ.) Mar. 1969 48 p refs
(INP-17881; Rept-69-52) Avail: AEC Depository Libraries

Plasma is confined by a pulsed helical magnetic field, whose longitudinal and azimuthal components are applied simultaneously. In the region outside the plasma column a dilute plasma is present. During the build-up of the confining field, currents are induced in this preexcitation plasma which cause the pitch of the magnetic field to be uniform in space and constant in time. The observed equilibrium position of the plasma column is in good agreement with the prediction of existing theory for a toroidal screw pinch surrounded by a uniform-and-constant-pitch magnetic field. These conditions for stability are found to be only weakly dependent on the aspect ratio of the torus. A correlation was found between the calculated growth time of the instability and the measured confinement time. A method is described to switch two capacitor banks in such a way that the magnetic field in the torus has a fast initial rise followed by a slow rise and a slow decay. A plasma pressure distribution was derived from detailed magnetic probe measurements along the minor diameter of the torus. Author (NSA)

N69-35368# Naval Research Lab., Washington, D.C.
THE EVOLUTION OF AN ARTIFICIAL IONOSPHERIC PLASMA CLOUD AS STUDIED BY HF AND VHF RADAR
J. R. Davis and S. R. Custey 3 Apr. 1969 20 p refs
(AD-688412; NRL-6865) Avail: CFSTI CSCL 4/1

A plasma cloud was created at an altitude of 94 km over Wallops Island by exploding a canister of a cesium compound, which had been fired from a 7-in. gun. This cloud was illuminated from NRL by hf and vhf radar. The results of coherent pulse doppler analysis of the cesium cloud signature indicate that the cloud evolved in a billowy manner, with turbulent eddies of about 10,000 sq m cross section appearing at several times within the nominal 70-sec duration of the signature. It was the presence of large-amplitude, specular echo components in the cloud signature that led to the suggested behavior of a cloud evolving in a billowy manner. The fact that these could be due instead to transient resonances in the plasma cloud cannot be completely discounted. Author (TAB)

N69-35378*# Israel Program for Scientific Translations, Ltd., Jerusalem.
ELECTRON CONCENTRATION BEHIND A SHOCK FRONT AND IN A GAS-DISCHARGE PLASMA IN A MAGNETOHYDRODYNAMIC SHOCK TUBE
V. A. Bashilov *In its* High-Temp. Properties of Gases, Phys. Gas Dyn., Thermodyn. and Phys. of Combust. 1969 p 105–107 refs (See N69-35365 20-12)
Copyright. Avail: CFSTI CSCL 20I

Time resolved emission spectra of ionized gas formed in an electromagnetic shock tube were analyzed. Electron concentrations were derived from measurements of the halfwidth of the H_β line assuming Stark broadening of the hydrogen lines. It was found that the values of the concentrations coincided with theoretical values, calculated from the conservation laws of the shock. Electron concentration measurements showed that there existed some transition region from the gas-discharge plasma to the pure gas with an increase in the direction of the gas discharge plasma. G.G.

N69-35380*# Israel Program for Scientific Translations, Ltd., Jerusalem.
ARGON PLASMA FLOW IN A CHANNEL WITH A TRANSVERSE MAGNETIC FIELD
G. P. Petrova and E. K. Chekalin *In its* High-Temp. Properties of Gases, Phys. Gas Dyn., Thermodyn. and Phys. of Combust. 1969 p 112–117 refs (See N69-35365 20-12)
Copyright. Avail: CFSTI CSCL 20I

The electromagnetic forces induced by a flowing plasma and the current in the electrodes circuit were studied for various magnetic fields and different plasmatrons. Emf and current plots

as functions of magnetic field strength for two lengths of quartz channel decreased with increasing channel length; this effect was attributed to the intense cooling of the plasma and the development of a boundary layer. G.G.

N69-35411# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
STUDY OF A PULSED DISCHARGE IN HYDROGEN USING THE FAR ULTRAVIOLET EMISSION OF AN ADDITIONAL ELEMENT: ELECTRON TEMPERATURE MEASUREMENT [ETUDE D'UNE DECHARGE PULSEE DANS L'HYDROGENE A PARTIR DE L'EMISSION DANS L'ULTRAVIOLET LOINTAIN D'UN ELEMENT ADDITIONNEL: MESURE DE LA TEMPERATURE ELECTRONIQUE]
Jean-Louis Schwob (Ph.D. Thesis--Paris Univ., 29 Jun. 1967) 1969 120 p refs In FRENCH; ENGLISH summary
(CEA-R-3359) Avail: CFSTI

The ionization and excitation of an additional element in a pulsed annular discharge in hydrogen at low pressure (T.A.2000) are described by means of a simple coronal type analytical model. This model allows to interpret the time variation of the intensity of spectral lines observed in the vacuum ultraviolet region. From this analysis two methods of electron temperature determination are deduced. The first method is based on the appearance times of the intensity maximum of the spectral lines emitted from successively created ions of the additional element (nitrogen). In the second method the electron temperature is determined from the intensity ratio of two spectral linesike ion. The transition couples (2s-2p, 2s-3p) and (2s-2p, 3s-3p) of C IV, N V and O VI have been used. The results obtained with these two independent methods are in good agreement. The electron temperature varies from a few electron-volts at the beginning of the discharge, to 70 eV at the time of N V emission (at 55μs), before the current maximum in the discharge (at 170 μs). Author (ESRO)

N69-35500*# National Aeronautics and Space Administration, Washington, D.C.
THE METHOD OF FINITE DIFFERENCES FOR SOLVING ONE-DIMENSIONAL NONSTATIONARY PROBLEMS OF MAGNETOHYDRODYNAMICS
A. A. Samarskiy et al Aug. 1969 18 p refs Transl. into ENGLISH from Zh. Vychislitelnoi Mat. i Mat. Fiz. (Moscow), v. 8, no. 5, 1968 p 1025-1038
(NASA-TT-F-12361) Avail: CFSTI CSCL 20I

The present article is devoted to a description of numerical methods of solving the equations of magnetohydrodynamics which are applied in the study of the T-layer phenomenon. It is assumed that thermal and electrical conductivities can be arbitrary functions of temperature and density. The method and the corresponding computer programs enable one to solve a large class of problems with various combinations of boundary conditions and equations of state. Account is also taken of the fact that the medium being studies may consist of several regions with various sharply differing physical properties. The real physical viscosity is neglected. The system of magnetohydrodynamic equations is solved by the method of finite differences. The procedure for solving the equations of hydrodynamics involving thermal conduction (without magnetic field), is used as a basis. Author

N69-35585# United Kingdom Atomic Energy Authority, Culham (England). Translations Office.
PRODUCTION AND HEATING OF PLASMA IN A MAGNETIC FIELD BY HIGH FREQUENCY WAVES
V. E. Golant Nov. 1968 25 p refs Transl. into ENGLISH of AN SSSR, Leningrad. Fiz.-Tekhn. Inst. Rept-092
(NP-tr-1768; CTO-531) Avail: AEC Depository Libraries

Experiments are described on the production and heating of plasma in a magnetic field under the action of microwaves in the 3 cm range using a borad band waveguide technique to feed energy to the plasma. The region of existence of a plasma in a homogeneous magnetic field and in magnetic mirror traps was determined as a function of the power input and gas pressure. It is shown that the region of existence of the plasma is determined by the conditions governing the absorption of the high frequency waves. The absorption mechanism is investigated, and it is found that at small electron densities the dominant part is played by absorption in the cyclotron resonance region. At densities approaching the critical value the absorption is related to hybrid resonance. Under these conditions the efficiency of the absorption attains 80 to 90%. For electron densities exceeding the critical, efficient absorption of the waves is recorded in magentic fields significantly exceeding the cyclotron field. Author (NSA)

N69-35579 Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.
ADIABATIC THEORY OF CHARGED PARTICLE MOTION IN AN ELECTROMAGNETIC FIELD [THEORIE ADIABATIQUE DU MOUVEMENT DES PARTICULES CHARGEES DANS UN CHAMP ELECTROMAGNETIQUE]
G. Laval and R. Pellat *In* CERTS Determination of Radiation Doses in Space [1968] p 39-48 refs In FRENCH; ENGLISH summary Prepared jointly with CERTS (See N69-35576 20-29)
Copyright Avail: Issuing Activity

The essential results of the adiabatic theory are established: the guiding center equations and the invariance of the magnetic moment and the longitudinal invariant are derived by using the asymptotic methods of the theory of non-linear oscillations. Author (ESRO)

N69-35663# European Space Research Inst., Frascati (Italy).
OBSERVATIONS OF CYCLOTRON HARMONICS IN LABORATORY PLASMAS AND IN THE UPPER IONOSPHERE
G. J. Landauer Oct. 1967 19 p refs Presented at the ESRO Summer School, Frascati, Italy, Aug. 1967
(ESRO-SN-86 (ESRIN)) Avail: CFSTI

After a brief survey of the work already undertaken in the field of cyclotron harmonic phenomena, the author begins by discussing synchrotron radiation of relativistic electrons and the formula for the power emitted, which is considered for the case of dipole radiation and of synchrotron radiation. Experimental results from laboratory plasmas and satellite observations are then compared, followed by a discussion of different theoretical treatments of the problem. The conclusion is drawn that the physical conditions responsible for the excitation of cyclotron harmonics in laboratory plasmas and in the upper ionosphere appear to be analogous and to be based on equal fundamental suppositions. The variety of the experimental results obtained, however, makes it difficult for one theory common to them all to be established and thus for the complete understanding of cyclotron harmonic phenomena to be achieved to date. Author (ESRO)

N69-35708# Kernforschungsanlage, Juelich (West Germany). Institut fuer Plasmaphysik.
INFRARED BREMSSTRAHLUNG FROM FULLY IONIZED PLASMAS [BREMSSTRAHLUNG VOLLIONISIERTER PLASMEN IM INFRAROTEN]
Dankwart Rusbueldt Mar. 1969 69 p refs In GERMAN
(JUEL-578-PP) Avail: CFSTI

The continuum radiation bremsstrahlung from a high temperature helium or deuterium plasma in the infrared range was measured by means of a duochromator, interference filters, and photoresistor and photodiode infrared detectors. Theoretically, the emitted continuum via the Gaunt-factor depends roughly in a

logarithmic fashion upon the frequency. The Gaunt-factor is derived both by classical and quantum mechanical methods and the dependence obtained was checked experimentally over a wide spectral region. ESRO

N69-35732*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYTICAL AND EXPERIMENTAL STUDIES OF MHD GENERATORS CATHODES EMITTING IN A "SPOT" MODE
Lester D. Nichols and Maris A. Mantenieks Washington Sep. 1969 refs
(NASA-TN-D-5414) Avail: CFSTI CSCL 20I

The sheath current-voltage characteristics for a plane cathode emitting current from a thermionic arc spot are derived. The derivation is based upon the requirement of energy conservation at the cathode spot and also in an ionization region adjacent to the spot. The results for given gas conditions and electrode work function predict a sheath voltage which decreases with both increasing current for a fixed undisturbed (i.e., far from the spot) cathode temperature, and increasing disturbed cathode temperature at a fixed current. Experimental data is shown which supports the conclusions predicted by the model. Author

N69-35736*# Illinois Univ., Urbana. Antenna Lab.
RADIATION FROM AN OPEN-ENDED WAVEGUIDE INTO AN INHOMOGENEOUSLY FILLED SPACE
R. J. Kostelnicek and R. Mittra Jul. 1969 83 p refs /ts Antenna Lab. Rept. No. 69-10
(Grant NGR-14-005-009)
(NASA-CR-105426; SR-12) Avail: CFSTI CSCL 20I

An analytic solution to the problem of radiation from an open-ended parallel-plate waveguide into a dielectric or plasma slab is obtained. The electromagnetic fields are formulated in terms of a discrete mode spectrum inside the waveguide and continuous mode spectra in the open regions. Mode matching at the waveguide aperture plane leads to a singular integral equation. A solution of this equation allows the determination of the fields throughout the whole of space. However, this equation is not solved directly, but instead, an auxiliary integral equation is formed from the original equation by employing the known exact solution of the canonical problem, viz., radiation from an open-ended waveguide into free-space. The auxiliary equation has the advantage that it may be solved exactly in an asymptotic sense. This asymptotic solution demonstrates that the correct edge condition is satisfied. Standard numerical techniques are employed, and results giving the fields and distribution of scattered power for a TEM incident mode are presented. Author

N69-35737# Forsvarets Forskningsanstalt, Stockholm (Sweden).
IONIZATION OF FLAMES, ESPECIALLY THE IONIZATION OF ROCKET FLAMES [JONISATION I FLAMMOR SPECIELLT JONISATION I RAKETFLAMMOR]
W-E Gunners Oct. 1967 134 p refs In SWEDISH
(FOA-2-A-2505-42) Avail: CFSTI

A selection of theoretical and experimental studies is presented based on a survey of the 175 works that are listed as references. The emphasis on electrical properties of rocket flames. The concentration of charged particles in the reaction zone of flames and means for varying the concentration are well covered. Two other broad aspects of flame ionization that are covered deal with magnetohydrodynamics and its applications in the generation of power, and the interference and damping effects caused by ionized flames in electromagnetic radiation. Also treated are experimental measuring methods, such as single- and double-electrode Langmuir probes, mass spectrometry, and the use of electromagnetic waves for determining electron concentration. Some calculations on flames in electrical and magnetical fields are discussed. Transl. by K.W.

N69-35758# Rome Univ. (Italy). Scuola di Ingegneria Aerospaziali.
DESCRIPTION OF THE INSTALLATION OF THE PLASMA GENERATOR AT CENTRO RICERCHE AEROSPAZIALI [L'IMPIANTO GENERATORE DI PLASMA DEL CENTRO RICERCHE AEROSPAZIALI]
Carlo Buongiorno and Vittorio Fiorini Jul. 1968 27 p refs In ITALIAN; ENGLISH summary Sponsored by Consiglio Nazl. delle Ric. /ts Atti del Centro Ric. Aerospaziali 17
Avail: CFSTI

A brief description of the 40 KW d.c. arc-jet installation at the Centro Ricerche Aerospaziali (Italy) is given. The arc jet with coaxial geometry and watercooled electrodes is installed in a vacuum chamber and discharges into a low pressure (below 3 mm Hg) environment. Details are also given on the jet calibration, first obtained with a calorimeter technique at ambient pressure, and the determination of the efficiency of the plasma jet. Author (ESRO)

N69-35800# TRW Systems, Redondo Beach, Calif.
RESEARCH ON INTERACTION OF PLASMA STREAMS WITH MAGNETIC FIELDS Final Report
J. M. Sellen, Jr. Apr. 1969 74 p refs
(Contract AF 49(638)-1538)
(AD-688885; TRW-04990-6001-R0-00; AFOSR-69-1226TR)
Avail: CFSTI CSCL 20/9

Low energy synthesized Cs+ plasma streams have been generated. Plasma densities of 10 to the 10th power ion/cu cm have been generated at ion streaming energies of 1 eV. Longitudinal velocity spreads of approximately 10 to the 4th power cm/sec are inferred from transverse velocity measurements and conservation of energy. Low energy streaming Cs+ plasmas have been directed into stationary thermal Cs+ plasmas. Longitudinal wave growth was not observed. Ion Landau damping of ion acoustic waves is greatly reduced by the presence of the streaming plasmas. Beam-related azimuthal drift waves were observed in a Q-machine confining field for this bi-plasma system. Plasma behavior has been observed for streaming plasmas interacting with transverse and longitudinal magnetic fields. Transport and cutoff of the plasma stream by transverse fields is consistent with Fried-Ossakow. Confinement of radially diverging plasma streams by longitudinal B-fields is exponential in B for 0 to approximately 100 gauss. Saturation in confinement is observed for B > approximately 100 gauss. Turbulence in plasma stream permits enhanced electron diffusion and limits effectiveness of B-field confinement. TAB

N69-35880# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.
OVERSTABLE MODES DUE TO RESISTIVITY GRADIENT
Franz Hermegger 31 Mar. 1969 23 p refs
(Contract F61052-67-C-0014)
(AD-688887; UNICP-SR59; AFOSR-69-1401TR) Avail: CFSTI CSCL 20/9

It has been shown that in an incompressible plasma sheet with resistivity gradients perpendicular to the main magnetic field overstable modes can exist. A criterion for overstability has been given. This criterion shows that the existence of overstability depends on the curvature of the curve of the resistivity. An approximate solution of the stability equation has been given. In the general case of an inhomogeneous plasma embedded in a constant gravitational field the region of neutral stability depends essentially on the resistivity gradient except if the plasma is homogeneous. Author (TAB)

N69-36922*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE MAGNETIC STRUCTURE OF INTERPLANETARY SPACE
Norman F. Ness Aug. 1969 61 p refs Presented at the 13th Intern. Conf. on Cosmic Rays, Budapest, 1969
(NASA-TM-X-63634; X-616-69-334) Avail: CFSTI CSCL 20I

A brief summary and overview of the present understanding of the interplanetary magnetic field structure is presented. Synoptic studies of the physical properties of the interplanetary medium and in particular the interplanetary magnetic field, revealed a sectoring or ordering of the direction and correlated variations of plasma velocity, density, terrestial magnetic activity, and long lived streams of cosmic rays. Second order results indicate a rich fine scale filamentary structure of the interplanetary medium in which individual flux tubes appear to be directly connected to the sun. From these detailed studies and long term observations, it is now possible to view the interplanetary medium as being structured on three characteristic time scales: microstructure, less than one hour; mesostructure, 1 to 100 hours; and macrostructure, greater than 100 hours. Author

N69-36968# Stichting Voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands). Inst. Voor Plasma-Fysica.
ON THE MARGINAL STABILITY OF LINEARIZED SYSTEMS
F. Santini Feb. 1969 29 p refs
(NP-17891) Avail: AEC Depository Libraries

The problem of the stability of a perturbed linearized system for modes proportional to $\gamma(r)e^{-i\omega t}$ yields an equation of the form $H(\omega)\gamma = 0$. General properties of the operator $H(\omega)$ give information on the stability of the admitted modes. The problem studied here regards conditions for marginal stability (appearance of an unstable solution near one known to exist at some real frequency ω_1. So far this problem has been studied for equations $H(\omega)\gamma = 0$ derivable from a Lagrangian, admitting a regular solution, while $H(\omega_1)$ is Hermitian for real ω. The main purpose of the present work is to investigate the marginal stability for more general systems including those which admit, in the limit of ω becoming real, a degenerate eigenvalue ω, singular solutions, or non-Hermitian operators. The latter case frequently occurs in plasma physics where the resonances make the system singular for real ω. Corresponding examples are mentioned. Marginal stability conditions aroung $\omega = 0$ are worked out for singular systems. Author (NSA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N69-34933# California Univ., Berkeley. Lawrence Radiation Lab.
DIRECT OBSERVATION OF MOTION OF DISLOCATIONS IN DEFORMED SILICON BY X-RAY TOPOGRAPHY
Vugranam Chakravarthy Kannan (Ph. D. Thesis) Jan. 1969 101 p refs
(Contract W-7405-eng-48)
(PB-183570; UCRL-18673) Avail: CFSTI CSCL 20B

Measurements of glide velocities of isolated individual dislocations as a function of temperature in the range 775-920C were made in silicon single crystals by x-ray Lang topography and the data was correlated with the appearance of the dislocation lines. Qualitative information was also obtained on the mobilities of dislocations at temperatures around approximately 1000C as well as on the generation and multiplication of dislocations during the initial stages of plastic deformation in highly perfect crystals. Under stresses far below the macroscopic yield point, dislocation generation invariably took place at or near the surfaces. Vacancy clusters or loops in a few quenched and aged specimens did not act as sources but rather were obstacles to the passage of dislocations. Although the average direction of all dislocations was along (110) none of the lines were perfectly straight suggesting that the Peierl's stress is not high enough to align the dislocations along the close-packed directions. The mobilities of dislocations generated at high temperatures were greatly diminished at lower temperatures. USGRDR

N69-35047# Gulf General Atomic, San Diego, Calif.
FORMAL EXPANSIONS FOR THE POTENTIAL ENERGY OF A DISTORTED CRYSTAL IN TERMS OF STRAIN PARAMETERS AND COMPONENTS OF A STATIC ELECTRIC FIELD
E. L. Slaggie 6 Jan. 1969 34 p refs
(Contract AT(04-3)-167)
(PB-183542; GA-9182) Avail: CFSTI CSCL 20B

The potential energy for a distorted crystal is expanded in powers of dynamic displacements from the distorted configuration. The expansion coefficients are expressed in terms of coupling parameters defined with respect to an undistorted reference lattice, which is related to the distorted lattice by external and internal strain parameters. The formulation is developed in such a manner that the invariance of the potential energy under rigid body rotations of the crystal is made explicit. The expansions are generalized to include the case of crystal containing a macroscopic electric field. Applications of this formalism to anharmonic lattice dynamical problems are given elsewhere. Author (USGRDR)

N69-35174# Oak Ridge National Lab., Tenn. Solid State Div.
ULTRASONIC MEASUREMENT OF THE TEMPERATURE DEPENDENCE OF COPPER NONLINEARITY PARAMETERS
Randall Douglas Peters (Ph.D. Thesis - Tenn. Univ., Knoxville) Apr. 1969 107 p refs
(Contract W-7405-eng-26)
(PB-183557; ORNL-TM-2286) Avail: CFSTI CSCL 20L

The nonlinearity parameters of copper single crystals were measured as a function of temperature in the range 77 to 300 degrees Kelvin. These parameters, which are combinations of third-order elastic constants, were measured by quantitatively determining the second harmonic distortion of pulsed MHz ultrasonic waves propagating in the three principal crystallographic directions. Using a pneumatically controlled variable gap capacitive detector, it was possible to determine the low-temperature values of the parameters relative to the room temperature values. The room temperature values were measured absolutely. The results indicate that over this temperature range the primary contributor to the third-order elastic constants is the closed-shell repulsive interaction of nearest neighbor atoms. Author (USGRDR)

N69-35180# Aktiebolaget Atomenergi, Stockholm (Sweden).
ON THE THEORY OF COMPENSATION IN LITHIUM DRIFTED SEMICONDUCTOR DETECTORS
A. Lauber Apr. 1969 46 p refs Submitted for publication
(AE-356) Avail: CFSTI

The lithium ion drift method produces detectors with a highly but not perfectly compensated intrinsic region. The amount of fixed space charge left in the depleted layer and its dependence on drift and clean-up parameters is of great practical interest. The imperfect compensation is mainly due to the presence in the depletion layer of thermally generated electron-hole pairs swept apart

by the voltage applied to the detector during drift. A theoretical model is developed which takes into account the influence on the fixed space charge of mobile carrier generation of free electrons and holes; the theory predicts the formation of linear space charge gradients. When recombination is strong a constant space charge throughout a large part of the compensated layer may result. The theoretical calculations are compared with experimental findings and the influence of space charge on detector performance is discussed. Author (ESRO)

N69-35282# Chicago Univ., Ill. James Franck Inst.
MICROSCOPIC DIELECTRIC FUNCTION OF A MODEL SEMICONDUCTOR
G. Srinivasan 1968 45 p refs
(Contract Nonr-2121(22))
(AD-688475) Avail: CFSTI CSCL 20/12

Penns model of an isotropic semiconductor is used to calculate epsilon (q), the diagonal part of the static microscopic dielectric function. Penns results have been extended beyond q = K sub F. This region is important in developing a quantum theory of lattice vibrations of diamond and zinc-blende crystals. Explicit results are given for the range $0 < q < 4K$ sub F. Author (TAB)

N69-35322# Clemson Coll., S.C. Dept. of Physics.
RADIATION EFFECTS IN CRYSTALLINE MATERIALS Progress Report, Apr. 1969
R. L. Chaplin Apr. 1969 13 p refs
(Contract AT(40-1)-3098)
(ORO-3098-12) Avail: CFSTI

Research was continued on the effects of 0.40-MeV electrons and their annealing in polycrystalline Al, high-purity Mg, and the metals Cu, Ti, and V. The dose dependence of the State I annealing of Al was studied. The annealing stages of polycrystalline Mg were examined, and experiments are in progress on Mg single crystals. Interpretations are presented from the annealing spectrum of high-purity Cu. Preliminary results are given for Ti. NSA

N69-35425# Oak Ridge National Lab., Tenn. Solid State Div.
ANNUAL PROGRESS REPORT FOR THE PERIOD ENDING 31 DECEMBER 1968
Apr. 1969 117 p refs
(Contract W-7405-eng-26)
(ORNL-4408) Avail: CFSTI

The status is discussed for solid state research tasks in the following areas: lattice dynamics, magnetic properties, electron spin resonance, electron and optical properties, low temperature properties, radiation damage, channeling, dislocations, radiation effects on plastic deformation and fracture, surface studies and X-ray diffraction, research materials, and experimental equipment. E.C.

N69-35427# Utah Univ., Salt Lake City. Dept. of Physics.
STUDY OF POINT DEFECTS BY MEANS OF DISLOCATION PINNING EFFECTS
A. Sosin 15 Dec. 1968 15 p refs Presented at the Intern. Conf. on Point Defects, Juelich, Germany Supported in part by North American Rockwell Corp.
(Contract AT(11-1)-1800)
(COO-1800-1; CONF-680954-1) Avail: CFSTI

A discussion is presented of the problems in the study of the point defect–dislocation interaction in dislocation pinning in metals. After a description of the vibrating-string model, the results of some irradiation-annealing studies in copper and gold are examined. The nature of dislocation pinning is discussed, and it is concluded that the point defect – dislocation interaction is complex and that there is no theory adequate for interpretation of the data. NSA

N69-35559 Centre d'Etudes et de Recherches en Technologie Spatiale, Toulouse (France).
THE EQUIVALENCE PROBLEM IN EVALUATING DEGRADATION OF SINGLE CRYSTALS [PROBLEME DE L'EQUIVALENCE POUR LES DEGRADATIONS DANS LES CELLULES MONOCRISTALLINES]
J. Bernard *In its* Determination of Radiation Doses in Space 1968 p 281–288 refs In FRENCH; ENGLISH summary (See N69-35576 20-29)
Copyright. Avail: Issuing Activity

When single silicon crystal solar cells are degraded by energetic electrons, the length of diffusion L varies with the dose ϕ according to the formula: $1/L^2 - 1/L_1^2 = K(E)\cdot\phi$. (E). The coefficient K (E) has been determined experimentally under ambient temperature as a function of the energy. Starting from certain hypotheses, this coefficient has been computed as a function of energy, temperature and resistivity. Values obtained experimentally are compared with the calculated values to show that it would be both possible and interesting to carry out in one operation experiments and computations on the same samples of silicon. Author (ESRO)

N69-35662# Institut National des Sciences et Techniques Nucléaires, Saclay (France).
POSITRON ANNIHILATION IN SOLIDS: POSITRONIUM DIFFUSION [ANNIHILATION DU POSITON DANS LES SOLIDES: DIFFUSION DU POSITONIUM]
Robert Paulin (Ph.D. Thesis–Paris Univ.) June 1969 126 p refs In FRENCH; ENGLISH summary
(CEA-R-3804) Avail: CFSTI

The existence of two slow components in the life-time spectrum of positron annihilation in silicon, aluminum and alkaline-earth oxide powders is established. These two long mean-lives $\simeq 10^{-9}$s and $\simeq 10^{-7}$s result from the annihilation, inside and outside the grains respectively, of the ortho-positronium formed in the defects in the ionic crystals investigated. The dynamic behavior of Ps, so revealed, is analyzed in terms of diffusion and is in excellent agreement with the experiments. Diffusion constants of the order of 10^{-4} cm^2 sec^{-1} and mean paths before annihilation varying from 50 to 2300 Å were measured. Only the diffusion process of SiO_2 was affected by varying the temperature in the range 100°–500°K, the activation energy being about 10^{-2}eV. The p–Ps zero point energy evaluated by angular correlation gave the order of magnitude for the defect dimensions and diffusion mean-time. The o–Ps behavior in the spaces between the grains, where its interaction with atmospheric gases can only be detected, is analyzed. Author (ESRO)

N69-35682# Delaware Univ., Newark. Dept. of Physics.
GROWTH OF SINGLE PLATELETS OF CADMIUM SULFIDE
Lodewijk van den Berg (M.S. Thesis) Jun. 1969 82 p refs
(AD-688903; TR-32) Avail: CFSTI CSCL 20/2

Single crystal platelets of Cadmium Sulfide were grown by evaporation of pure Cadmium Sulfide powder in a gas stream and subsequent crystallization by gradual cooling of the vapor phase. Parameters which influence the rate of growth were defined and varied in order to optimize the growth process. Two variables, the concentration of Hydrogen Sulfide in the carrier gas and the temperature gradient in the crystallization region, were selected for further investigation. A theoretical model has been developed

which makes it possible to calculate the supersaturation in the gas phase for the different growth conditions and which relates this supersaturation with the habit of the crystals. The results of the model are compared with the experimental results. Author (TAB)

N69-35963# Army Electronics Command, Fort Monmouth, N.J.
GRAIN SIZE EFFECTS ON SWITCHING PROPERTIES OF LITHIUM FERRITES
R. W. Babbitt, G. Sands, and A. Dunlap Apr. 1969 25 p refs
(AD-688881; ECOM-3107) Avail: CFSTI CSCL 20/2

The study was made to determine the effects of grain size on the switching properties of lithium ferrite. Lithium ferrite ($Li_{.5}Fe_{2.5}O_4$) powders were prepared by five different techniques which were freeze drying, flame spraying, standard commercial processing, fluid-bed reaction, and reaction of $Li_2CO_3 + Fe_2O_3$ mixture. These powders were densified by hot pressing or conventional sintering. Except for the freeze-dried powder, their magnetic properties were similar for a given grain size, but their densification and grain growth characteristics varied greatly. The magnetic properties evaluated as a function of grain size were coercive force, switching speed, switching constant, squareness, and temperature stability. These properties were evaluated over a 0.7 to 16.0 micron grain size range and the effects of grain size on switching speed and coercive force were established. It is shown that samples with a 5.0 micron grain size have more than a two times faster switching speed with little or no increase in coercive force, when compared with 16.0 micron grain size samples. Author (TAB)

N69-35973# Toulouse Univ. (France). Faculté des Sciences.
PROTON-SILICON AND PROTON-GERMANIUM INTERACTIONS BETWEEN 1 AND 3000 MeV [INTERACTIONS PROTON-SILICIUM ET PROTON-GERMANIUM ENTRE 1 ET 3000 MeV]
Yann Gervais de Lafond (Ph.D. Thesis) 12 May 1969 219 p refs In FRENCH
Avail: CFSTI

This report is concerned with the interactions of high energy protons with semiconductor materials. A single mathematical expression, which is valid between 1 and 3000 MeV, has been developed for the parameters of proton-nuclei interactions and is then applied to the analysis of atom-atom cascade interactions. The results are then used to evaluate high energy proton damage to silicon and germanium semiconductor devices and to classify the defects according to their geometrical shape. Fortran computer programs were written for the calculation of atomic deplacements produced by the elastic diffusion of high energy particles. ESRO

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N69-35096# Forsvarets Forskningsanstalt, Stockholm (Sweden).
EFFECT OF METALLIC COMPOUNDS ON THE COMBUSTION CHARACTERISTICS OF SOLID ROCKET PROPELLANTS WITH POLYBUTADIENE BASE [METALLFOERENINGARS INVERKAN PA FOERBRAENNINGSEGENSKAPERNA HOS RAKETKRUT PA POLYBUTADIENBAS]
Bengt Forshaellen Nov. 1967 38 p refs In SWEDISH
(FOA-2-C-2205-42) Avail: CFSTI

Tests were conducted to achieve increased combustion velocity of ammonium perchlorate - polybutadiene powders by adding metallic compounds, chiefly metal oxides. Combustion velocities were determined as a function of combustion chamber pressure at constant temperature. The chamber pressure varied between 20 bar and 300 bar with the powder at 20° C. The results indicate that the best effects are obtained with additions of copper chromate and iron (II) oxide, followed by chromium (III) oxide. Copper chromate and chromium (III) oxide additions result in plateau burning of the propellant. Additives that were also investigated but showed no catalytic effects included ammonium dichromate, ammonium chromate, cyanoferrate, copper (II) oxide, manganese (IV) oxide, nickel (II) oxide, and zinc oxide. Transl. by K.W.

N69-35167# Politecnico di Torino (Italy). Istituto di Macchine e Motori per Aeromobili.
KNOCK CHARACTERISTICS OF PARAFFIN BASE, CYCLIC PARAFFIN BASE AND AROMATIC HYDROCARBONS CONSTITUENTS OF FUEL FOR AUTOMOBILES [CARATTERISTICHE DI DETONAZIONE DI IDROCARBURI PARAFFINICI, CICLOPARAFFINICI ED AROMATICI CONTENUTI NEI CARBURANTI PER AUTOTRAZIONE]
Enrico Antonelli Dec. 1968 48 p refs In ITALIAN; ENGLISH summary
(Publ-108) Avail: CFSTI

By means of an instrument, which counts the number and measures the amplitude of the knock typical pressure oscillations, knock intensity measurements have been taken on a C.F.R. engine on varying the spark advance, the fuel/air ratio and the angular speed. The tests have been carried out with one of seven main hydrocarbons (n-hexane, n-haptane, n-Octane, isooctane, cyclohexane, benzene and toluene) and with a super fuel. The results of the tests, plotted in graphs, have been analyzed in order to obtain a further indication in the choice of the hydrocarbons fittest to correct the fuel knock characteristics. Author (ESRO)

N69-35321*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SOME LIQUID OXYGEN/LIQUID HYDROGEN EXPLOSIVE EFFECTS IN CONTROLLED FAILURE-MODE TESTS
Richard W. High Washington Sep. 1969 33 p refs
(NASA-TN-D-5382) Avail: CFSTI CSCL 21I

The explosive yield data from three launch vehicle propellants are analyzed and compared. These data from controlled failure mode tests are found to be proportional to the interface area of contact between the fuel and oxidizer. The comparison of the data at short delay times suggests that, when the interface area of contact is equal, the potential hazard of liquid oxygen/liquid hydrogen is similar to that of liquid oxyben/kerosene and to nitrogen tetroxide/Aerozine-50. Author

N69-35636# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ALUMINUM PARTICLE IGNITION
T. I. Alekseev et al 31 Jan. 1969 19 p refs Transl. into ENGLISH from Tr. Leningr. Politekhn. Inst. (Moscow), no. 280, 1967 p 98–106
(AD-687639; FTD-MT-24-500-68) Avail: CFSTI CSCL 21/9

To clarify the concepts of the process of the preheating and ignition of aluminum particles used as additives in solid propellants, an analytical study was made of the ignition limits and induction time. It was shown that the optimal particle size increases

as the temperature of the ambient medium decreases. The calculated induction time was shown to be about proportional to the square of the particle size up to the dimensions which are limiting for ignition. Author (TAB)

N69-35716*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
SOME PROPERTIES OF LITHIUMHYDRIDE WITH RESPECT TO ITS USE AS A ROCKET FUEL. PART 1: THE DENSITY OF LIH FUEL GRAINS MADE BY COMPRESSION OF LIH POWDER [EINIGE EIGENSCHAFTEN VON LITHIUMHYDRID IM HINBLICK AUF SEINE VERWENDUNG ALS RAKETENBRENNSTOFF. 1 TEIL: DICHTE VON LIH-PRESSKOERPERN]
Roger E. Lo Washington NASA Aug. 1969 15 p Transl. into ENGLISH from German Reports DLR-EB 65-49, DVL-444
(Contract NASw-1692)
(NASA-TT-F-12454; DLR-FB-65-49; DVL-444) Avail: CFSTI CSCL 21I

The production of LiH fuel grains for combustion in hydride rocket motors is described. An empiric formula is derived for calculating the density which is to be expected at various pressures of formation for LiH fuel grains of given mass and cross section. Author

N69-35977# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Munich (West Germany). Inst. für Flugtreib- und Schmierstoffe.
FUELS FOR FLIGHT SPEEDS UP TO MACH 3.5 [KRAFTSTOFFE FUER FLUGGESCHWINDIGKEITEN BIS MACH 3,5]
Günter Spengler and Robert Erlmeier *In its* DVL News, No. 39 Mar. 1969 p 439-442 In GERMAN (See N69-35976 20-34)
Avail: CFSTI

Fuels were developed on an experimental basis which meet the requirements for supersonic transport fuels as to thermal stability, vapor pressure and bubble formation, energy content, combustion performance and low temperature performance (freezing point). Properties of fuels so produced were investigated by means of conventional and spectroscopic methods. ESRO

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N69-34674*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROPULSION SYSTEMS FOR MANNED EXPLORATION OF THE SOLAR SYSTEM
W. E. Moeckel Washington Aug. 1969 37 p refs
(NASA-TM-X-1864) Avail: CFSTI CSCL 21H

The first portion of this report relates planetary round-trip times to the performance parameters of two types of propulsion systems: type I is specific-impulse limited (with high thrust), and type II is specific-mass limited (with low thrust). The second part of the report discusses advanced propulsion concepts of both types and evaluates their limitations. The discussion includes nuclear-fission rockets (solid, liquid, and gaseous core), nuclear-pulse propulsion, nuclear -electric rockets, and thermonuclear-fusion rockets. Particular attention is given to the last of these, because it is less familiar than the others. A general conclusion is that the more advanced systems, if they prove feasible, will reduce trip time to the near planets by factors of 3 to 5, and will make several outer planets accessible to manned exploration. Author

N69-34726# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PRESENT STATUS AND PROSPECTS FOR APPLICATIONS OF ION THRUSTORS [PERSPECTIVES ACTUELLES DE DEVELOPPMENT ET D'APPLICATIONS DE LA PROPULSION IONIQUE]
Emile Le Grives 1969 44 p refs In FRENCH; ENGLISH summary
(ONERA-NT-149) Avail: CFSTI

Basic concepts of the electrostatic acceleration of particles are first recalled, then the various types of ion thrusters that are most thoroughly developed according to the present state of the art are reviewed. The topics covered are the following: cesium contact ion thrusters, ability for microscaling, electron bombardment mercury and cesium ion thrusters, range of attainable thrusts, heavy particle thrusters, and potential power-savings. Problems of life-time, reliability, compatibility with solar panel systems, and improvements now expected in the range of attainable specific impulses as well as in the reduction of feed voltages are given. Various missions for which ion thrusters are well suited are briefly analyzed. Station keeping and attitude control of stationary satellites, application to drag-free satellites, orbital transfer, with special reference to the British project X5, and space probes for interplanetary mission. Author

N69-34803# Dornier-Werke G.m.b.H., Munich (West Germany).
HORA
R. G. Reichert and A. Drtil *In its* Dornier-Post, No. 4, 1968 [1969] p 19-23 (See N69-34802 20-02)
Avail: CFSTI

The requirements for different space probe missions in the solar system are outlined and the advantages of a versatile kick stage rocket using jettisonable fuel tanks are discussed using fluorine/oxygen and hydrogen/oxygen fuels. ESRO

N69-34887*# Northrop Corp., Huntsville, Ala.
ACOUSTIC LOADS AT THE BASE OF ENGINE CLUSTERS
D. O. Barnett and H. A. Cikanek May 1969 110 p refs
(Contract NAS8-20082)
(NASA-CR-61286; Rept-61285; TR-784-9-536) Avail: CFSTI CSCL 21E

Determination of acoustic and hydromechanically induced dynamic loads at the base of Saturn configured vehicles is covered. An experimental program was conducted in support of this goal using a clustered rocket model and the cold flow duct. Schlieren and shadowgraph photography were used to determine the flow geometry and shock structure of plume clusters. In those regions determined of interest from the photographic data, pitot pressure distribution across the plumes were measured. Finally, the static and dynamic pressure distributions were measured on a rigid baseplate for simulated rocket clusters of one to five engines exhausting over a range of stagnation-to-ambient pressure ratios. Data are reported on distributions of mean static pressures and root-mean-square levels, power spectral densities, and space-time correlations of the fluctuating pressures at the base of engine clusters. Additionally, the distributions of velocities and pressures across the jets and the extent of the shear layer are given. Author

N69-34813*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTERNAL THRUST AND PUMPING PERFORMANCE OF AN AUXILIARY INLET EJECTOR NOZZLE WITH CLAMSHELL THRUST REVERSER
Ali H. Mansour and Richard R. Burley Jun. 1969 58 p refs
(NASA-TM-X-52821) Avail: CFSTI CSCL 21H

Data were obtained over a range of pressure ratio from 2 to 31 and corrected secondary weight-flow from 2 to 8% for three configurations which simulated take-off, transonic acceleration, and supersonic cruise flight conditions. A clamshell thrust reverser was fixed in positions approximately corresponding to those in flight operation. Adding tertiary air to the ejector improved performance at low pressure ratios. A maximum thrust coefficient of about 99% was obtained at take-off, and about 99.5% at supersonic cruise. Author

N69-34964*# Camin Labs., Inc., Brooklyn, N.Y.
DEVELOPMENT OF ELECTROFORMING TECHNIQUES FOR THE FABRICATION OF ROCKET ENGINE INJECTORS Final Report, Phase 2
Vito D. Agosta and Sanford S. Hammer Apr. 1969 74 p
(Contract NAS9-6177)
(NASA-CR-101801) Avail: CFSTI CSCL 21H

The feasibility of fabricating injectors by the electroforming process is discussed. The design, fabrication, and hydraulic flow tests of 100-pound thrust rocket engine injectors for use with hypergolic earth storable bipropellants are presented. Six conceptual injector designs were generated of which two were selected for fabrication. Four injectors of each configuration were fabricated and subjected to testing in order to demonstrate reproducibility of design and hydraulic characteristics. Author

N69-35125*# Rocketdyne, Canoga Park, Calif.
PROTECTIVE COATING SYSTEM FOR A REGENERATIVELY COOLED THRUST CHAMBER Final Report, 30 Jun. 1967 – 31 Jan. 1969
H. W. Carpenter Feb. 1969 316 p refs
(Contract NAS3-11187)
(NASA-CR-72569; R-7775) Avail: CFSTI CSCL 21H

A ceramic coating system is desired for thermal protection of the thrust chamber wall in a high performance, liquid hydrogen/liquid oxygen fueled rocket engine. This heat barrier coating is intended to reduce the heat flux through the chamber wall, reduce the metal wall temperature to less than 1600°F, operate with a 4000°F surface temperature, and survive multiple engine starts. Several material systems were selected for initial experimental evaluation. Based on screening type arc plasma jet tests that simulated the thermal conditions of the reference rocket engine, one coating system of those selected appeared to be adequate. The coating consists essentially of phosphate bonded zirconium oxide and was found to be hard, strong, refractory and resistant to thermal shock. The coatings were applied on Hastelloy X sheet by several aqueous slurry coating methods, and only a 600°F curing treatment was required before service. Author

N69-35386# Politecnico di Torino (Italy). Istituto di Macchine e Motori per Aeromobili.
VACUUM CHAMBER FOR TESTING OF ARC JET THRUSTORS [IMPIANTO PER PROVE CON ARCOGETTI IN SIMILITUDINE SPAZIALE]
M. Oggero and C. Bertolo May 1967 28 p refs In ITALIAN; ENGLISH summary
(Publ-73) Avail: CFSTI

A description of the vacuum chamber built at the Istituto di Macchine e Motori per Aeromobili of the Politecnico di Torino for altitude testing of arc jet thrustors is given. The instrumentation used in connection with this chamber will allow to measure and record on an oscillograph recorder thrust, heat balance of the cooling system, propellant mass flow, electric power input, and intensity of the stabilizing magnetic field even when these quantities are rapidly varying with time. A brief summary is given of the results of the tests made on the chamber and related equipment. Also the results of some test made on an arc jet thruster, exhausting at atmospheric pressure, with different intensities of the stabilizing magnetic field are given. It is shown that in the arc jet investigated (using gaseous nitrogen as a propellant) the stabilizing magnetic field has very little influence on the specific impulse which tends to decrease with increasing magnetic field intensities. However it is advisable to use a stabilizing field, even of small intensity, in order to increase the heat exchange efficiency between the arc and the flowing gas. Future testing in the vacuum chamber will investigate if it is possible to optimize the intensity of the stabilizing field for any propellant mass flow and current intensity. Author (ESRO)

N69-35433*# Philco-Ford Corp., Newport Beach, Calif. Aeronutronic Div.
EFFECT OF SOLID PROPELLANT ROCKET EXHAUST IMPINGEMENT ON SPACECRAFT MATERIALS Final Report, 18 Mar. 1966 – 21 Feb. 1969
C. H. Lewis 19 Mar. 1969 58 p refs Prepared for JPL
(Contracts NAS7-100; JPL-951246)
(NASA-CR-105230; U-4609) Avail: CFSTI CSCL 21H

Gaseous and hypervelocity impingement effects on spacecraft design were reviewed and some computational methods for gas particle flows in high altitude rocket plume flow field were outlined. The experimental phase was devoted to the study of the impingement damage effect on micron size particles typical of solid propellant rocket exhausts. A helium gas flow facility, a hydrogen-oxygen rocket motor, and a small scale solid propellant rocket motor were used to accelerate micron size aluminum oxide particles to velocities ranging from 4000 ft/sec to over 10,000 ft/sec. These particles impinged on instrumented target samples. Effects such as material removal, particle heating, and surface alteration were studied. The existence of a particle shielding effect was found to be of prime importance in reducing particle impingement damage. Particle heating was found to be of the order of 10 percent or less of the particle incident kinetic energy flux. Author

N69-35458*# Battelle Memorial Inst., Columbus, Ohio.
STATUS AND TRENDS OF AUTOMATED SPACECRAFT PROPULSION AND THEIR IMPLICATIONS TO SPACE TRANSPORTATION SYSTEM PLANNING
D. S. Edgecombe 18 Apr. 1969 119 p refs
(Contract NA5w-1146)
(NASA-CR-105312; BMI-NLVP-TM-69-5) Avail: CFSTI CSCL 21H

This report summarizes the results of a recent examination of current automated spacecraft propulsion technology and probable future requirements for automated spacecraft propulsion. The implications to space transportation system planning are emphasized. An attempt was made to cover all pertinent forms of spacecraft propulsion (particularly chemical and solar electric propulsion systems) for missions of potential interest to OSSA. The report is intended to serve as a general reference document for space transportation system advance planners. Author

N69-35473*# TRW Systems Group, Redondo Beach, Calif.
PROPULSION BEAM DIVERGENCE EFFECTS Quarterly Technical Report

15 Aug. 1969 47 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952350)
(NASA-CR-105276; QTR-2) Avail: CFSTI CSCL 21H

The second phase of a program to develop understanding of and tolerance-level criteria for the deleterious effects of electrostatic rocket exhaust (Cs, Cs $^{+}$, Hg, Hg $^{+}$) impinging on typical classes of spacecraft surfaces is underway. Prior work was done under Contract No. NAS7-575. This phase includes fabrication of necessary experimental fixtures and exploratory experiments. The current status of fixture design, fabrication, and testing is reported along with early experimental results. Immersion at approximately 20°C of Teflon FEP, and Kapton (H-film) in liquid Cs (but not Hg) and of Pb/Sn solder in both Cs and Hg produced important degradation of sample properties. Sylgard 182, Delrin, GT 100 and SMRD 745, which are representative of additional organic matrices found in spacecraft materials, appeared unaffected by immersion in Hg and Cs. Silver reacted with Hg rather slowly. Author

N69-35479*# TRW Systems Group, Redondo Beach, Calif.
THROTTLEABLE THRUSTOR SYSTEM Quarterly Progress Report, 29 Apr. – 25 Jun. 1969
18 Aug. 1969 13 p Prepared for JPL
(Contracts NAS7-100; JPL-952344)
(NASA-CR-105277; TRW-69.4726.3-64; QPR-1) Avail: CFSTI CSCL 21H

A study and analysis of various sytems capable of meeting specified requirements of a throttleable thrustor system, was conducted. Initially, design goals for the system and potential approaches toward achievement of these goals were listed. Advantages and disadvantages of these approaches were compared and used to compile a matrix of possible system designs. These designs were compared on the basis of mission performance, concept feasibility, required development and alternate approach representation. Nine candidate design concepts were selected for the remainder of the study. Three types of studies were scheduled to be accomplished: system performance, flow control tradeoffs and preliminary design. Effort was initiated in each of these areas. Author

N69-35526*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUBSONIC PERFORMANCE CHARACTERISTICS OF A LARGE-SCALE 1.075-PRESSURE-RATIO TIP-TURBINE CRUISE-FAN PROPULSION SYSTEM
Francis J. Capone and Harry T. Norton, Jr. Washington Aug. 1969 278 p refs
(NASA-TN-D-5314) Avail: CFSTI CSCL 21E

An investigation has been conducted in the Langley 16-foot transonic tunnel to determine internal and external performance characteristics of a large-scale 1.075-pressure-ratio tip-turbine cruise fan. The intent of this investigation was to determine trends rather than absolute levels in performance since the fan was originally designed as a low-pressure-ratio lift fan. The effects of geometry change and exit-area variation on performance were determined with three fan cowls, afterbodies, and nozzle-exit plugs. The gas generator was closely coupled to the fan and resulted in a gas-generator nacelle that extended forward and below the fan nacelle. Eight configurations were investigated at Mach numbers from 0 to 0.05 and at an angle attack of 0°. The test Reynolds number based on the fan diameter (36.00 inches (91.44 cm)) varied from 3.90×10^{6} to 11.25×10^{6}. The results showed that the fan operated at the design pressure ratio or near design fan rotational speeds for all configurations. Only changes in exit area affected internal performance. Because the net thrust decreased rapidly with increasing free-stream Mach number (due to low-pressure-ratio fan), the drag-minus-thrust coefficients became positive for all the configurations tested above a Mach number of 0.50. Author

N69-35533*# Dynamic Science Corp., Monrovia, Calif.
TRANSIENTS INFLUENCING ROCKET ENGINE IGNITION AND POPPING Interim Report
T. R. Mills, B. P. Breen, B. R. Leever, and E. A. Thachenko 30 Apr. 1969 88 p refs
(Contract NAS7-467)
(NASA-CR-105315; SN-95E) Avail: CFSTI

The effects of engine design and operating parameters on high-amplitude pressure waves (spikes) associated with vacuum starts using hypergolic propellants were studied. A computer program was synthesized for solving the sequence of processes from initial propellant injection to ignition. These processes, consisting of injected propellant flow transient, vaporization, and preignition chemistry, lead to early combustor environments which either give smooth ignition or can be conducive to destructive processes. The potential magnitude of pressure waves can be computed at selected times throughout the chamber pressurization transient. Vacuum starts were analyzed to determine the effect of initial conditions on chamber pressure, gas temperature, product species, and potential detonation pressure. The effects of time steps, droplet size distribution, heat transfer between gases and wall, transient propellant flow, and preignition chemistry on pressure history were evaluated. A separate study of high pressure waves during steady-state combustion (pops) was conducted, and literature and experimental data were used to perform order-of-magnitude calculations. Photographs showed injection mixing explosions to be a possible source of engine roughness or popping. K.W.

N69-35576# Politecnico di Torino (Italy). Istituto di Macchine e Motori per Aeromobili.
FREE JET SUPERSONIC DIFFUSERS FOR AEROSPACE ENGINE TESTING [STUDIO DI DIFFUSORI SUPERSONICI PER IMPIANTI DI PROPULSORI AEROSPAZIALI A GETTO LIBERO]
C. Bertolo and G. Sussi Dec. 1967 27 p refs In ITALIAN; ENGLISH summary Presented at the AIDA-AIR Natl. Congr., Milan, 5–8 Oct. 1967 Sponsored by Consiglio Natl. delle Ric.
(Publ-93) Avail: CFSTI

Experimental tests on simple free-jet diffusers (conical inlet and outlet connected by a cylindrical section) are described, and the influence of various geometrical and thermodynamical parameters is discussed. The optimum values of pressure recovery are plotted against the ratio of the area of the nozzle exhaust section to the area of the diffuser cylindrical section. A theoretical approach to the problem of evaluating the pressure recovery is presented, and the results are compared with the experimental ones. Author (ESRO)

N69-35619# Rocket Propulsion Establishment, Westcott (England).
ELECTRIC PROPULSION BY RESISTOJETS
W. T. Lord, J. A. Donovan, and Ann Savage [1969] 17 p refs Presented at the 5th Brit. Interplanet. Soc. European Space Symp., London, 14–16 May 1969
Avail: CFSTI

A brief description of resistojets and an outline of the experimental work are given, followed by a discussion of some results of a mission analysis of the transfer of a communications satellite to synchronous orbit. The analysis considers satellites which have given requirements of power per unit mass for operation in synchronous orbit. The consequences of this approach are found to be very significant, especially for satellites requiring high specific power. Propulsion by thrustors of given exhaust velocity is considered, and in particular it is shown that the hydrogen resistojet offers an attractive compromise between payload and transfer time. For a hydrogen resistojet it is possible to suggest a definite trade-off range, and examples are given for satellites with a specific

power of 4.4 W/kg (2W/lb). By using state-of-the-art values for the various parameters associated with the parking orbit, the solar array and the thruster, it is found that the range of performance extends from a payload of 37 percent of the initial mass in a transfer time of 2 months to a 53 percent payload in 4.2 months, while by using plausible development values for the parking orbit and solar array parameters the range extends from a payload of 50 percent in 1 month to a payload of 64 percent in 2.3 months. These performance figures may be of interest to operators of communications satellites, and highlight the need for research and development on the outstanding technological problem of long term hydrogen storage and supply. Author (ESRO)

N69-35631*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

EXTRAPOLATION AND INTERPOLATION OF THE THERMODYNAMIC CHARACTERISTICS AND PARAMETERS OF A ROCKET ENGINE [EKSTRAPOLYATSIYA I INTERPOLYATSIYA TERMODINAMICHESKIKH KHARAKTERISTIK I PARAMETROV RAKETNOGO DVIGATELYA]

V. Ye. Alemasov et al. Washington NASA Aug. 1969 13 p refs Transl. into ENGLISH from Tr. Kazansk. Aviats. Inst., Ser. Aviat. Dvigateli (Kazan), no. 88, 1965 p 12–20
(Contract NASw-1692)
(NASA-TT-F-12536) Avail: CFSTI CSCL 21H

The development of modified extrapolation and interpolation formulas for evaluating the performance and the parameters of a rocket engine is discussed. The formulas represent more convenient versions of formulas proposed previously and also incorporate a number of thermodynamic values and their derivatives found by thermodynamic calculations. The extrapolation results are in good agreement with the results of exact thermodynamic calculations over a wide range of parameter variations. The extrapolation of the specific thrust involves the greatest error and should be borne in mind as a factor restricting the accuracy of the method. Author

N69-35649# Army Foreign Science and Technology Center, Washington, D.C.

STAND FOR SIMULATED TESTS OF JET ENGINE EJECTOR NOZZLES

Yu. N. Nechaev and V. Zhilin May 1969 9 p Transl. into ENGLISH from Russian Patent no. 191171 (19 May 1965) 9 p
(AD-688900; FSTC-HT-23-1103-68) Avail: CFSTI CSCL 14/2

The new features of the proposed stand for simulated tests of jet engine ejector nozzles are said to include a more accurate draft-gauging system and provide for an optimal location of the nozzle cap in relation to the ferrule. The zero position of the stands supporting surface is controlled by electrical data units with a view to enhancing the draft-measuring accuracy. Author (TAB)

N69-35670*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ANALYSIS OF SST TURBOJET ENGINES DESIGNED FOR PART-POWER TAKEOFF TO REDUCE JET NOISE

John B. Whitlow, Jr. 1969 28 p refs
(NASA-TM-X-52867) Avail: CFSTI CSCL 21H

The design of noise suppressors which operate in the hot environment of afterburning turbojet SST engines may be quite difficult. They are likely to be heavy, introduce thrust losses, and be of questionable effectiveness. The sideline noise goal proposed by the FAA can be met without suppressors, according to this analytical study, by oversizing the engines to increase the airflow while simultaneously reducing the jet velocity. By switching from afterburning to dry turbojets, this noise goal can be met with a range penalty of 138 nautical miles (256 km) (about 3.4 percent). Although the design turbine inlet temperature remains unchanged, the oversize engines permit cruise to occur 300° F (167° C) below design. Author

N69-35683# Politecnico di Torino (Italy). Istituto. di Macchine e Motori per Aeromobili.

SPEED REGULATION OF GAS TURBINE ENGINES FOR AUTOMOBILES [TACHIREGOLAZIONE DEI TURBOMOTORI A GAS PER AUTOTRAZIONE]

A. Dadone Assoc. Tec. Automobile Oct. 1967 46 p refs In ITALIAN *Its* Ric. ATA, Quaderno 13, Suppl. to No. 10
(Publ-84) Avail: CFSTI

A speed regulator for gas turbine engines which controls the fuel flow by the action of centrifugal masses is described. A theoretical analysis of the transient response of the control system, neglecting the fluidodynamic transients and the internal transients of the regulator itself, is presented and discussed. The speed variations for the two axes of the engine are described and a practical example is discussed. ESRO

N69-35704*# TRW Systems Group, Redondo Beach, Calif.

APOLLO 10 LM-4, DESCENT PROPULSION SYSTEM FINAL FLIGHT EVALUATION

R. K. M. Seto 8 Aug. 1969 45 p refs
(Contract NAS9-8166)
(NASA-CR-101869; TRW-11176-H314-R0-00) Avail: CFSTI CSCL 21H

The performance of the LM-4 descent propulsion system during the Apollo 10 mission was evaluated and found to be satisfactory. Because system data during the DOI maneuver was not recorded and due to the short length of burns, no detailed performance study using the Apollo propulsion analysis program was possible. However, the preflight model was used with flight data to approximate the performance at representative times during the phasing burn. For minimum throttle operation and FTP thrust, specific impulse, and mixture ratio were calculated. Instrumentation biases were determined on the regulator outlet pressure measurement, the oxidizer interface pressure measurement, and the chamber pressure measurement. The supercritical helium tank experienced an average pressure rise rate of 5.84 psi/hr during the coast period between launch and first DPS engine firing. This value was less than anticipated from ground tests. Although the fuel quantity gages never read off scale (greater than the maximum 95 percent indication) as expected prior to the phasing burn, they did respond with propellant consumption and were within both the expected accuracy of 3.5% and the specification limits of 1.3% at the end of the burn. The oxidizer gages operated as expected prior to the phasing burn. Author

N69-35706*# Hughes Research Lab., Malibu, Calif. Plasma Physics Dept.

HIGH-TEMPERATURE LM CATHODE ION THRUSTORS Final Report, 5 Feb. 1968 – 15 Apr. 1969

J. Hyman, Jr., W. O. Eckhardt, J. R. Bayless, J. A. Snyder, and J. W. Pfeifer 15 Apr. 1969 118 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952131)
(NASA-CR-105424) Avail: CFSTI CSCL 21H

A thermally integrated 30-cm LM cathode thruster and a 20-cm thruster employing an externally cooled LM cathode have been developed along with an LM cathode neutralizer and components of a liquid-mercury feed system. Over-all efficiency $\eta_t = 72.6\%$ is achieved by the 30-cm LM cathode thruster system at beam current $I_B = 1.155$ A and specific impulse $I_{sp,eff} = 3990$ sec. The system includes a single-capillary-fed thermally integrated LM cathode, a liquid-mercury high-voltage isolator, an

EM pump, and an LM cathode neutralizer. When fully optimized, the thruster achieves a mass utilization efficiency $\eta_n = 84\%$ with a total source energy per ion $V_S = 250$ eV/ion. The Lm cathode reaches normal operating temperature (~200°C) by a balance between discharge heating and cooling by radiation from the thruster body. Author

N69-35712*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A COMPARISON OF EXPERIMENTAL AND CALCULATED HELIUM REQUIREMENTS FOR THE PRESSURIZATION OF A CENTAUR LIQUID HYDROGEN TANK

Raymond Lacovic Washington Sep. 1969 15 p refs

(NASA-TM-X-1870) Avail: CFSTI CSCL 21I

Ramp pressurization tests were conducted with gaseous helium in a thick-walled liquid hydrogen tank with the shape and approximate volume of a Centaur liquid hydrogen flight vehicle tank. The helium requirements were obtained at two pressure levels above liquid hydrogen saturation pressure, at four tank ullages, and for various ramp times. For all except small ullages there was good agreement between the experimentally determined helium requirements and the requirements predicted by an analytical program developed at the Lewis Research Center. Author

N69-35745*# Douglas Aircraft Co., Long Beach, Calif.

THE INTEGRATION OF QUIET ENGINES WITH SUBSONIC TRANSPORT AIRCRAFT Final Report

1 Aug. 1969 411 p refs

(Contract NAS3-11151)

(NASA-CR-72548; DAC-68510A) Avail: CFSTI CSCL 21H

The feasibility of retrofitting an advanced technology, high bypass ratio engine, incorporating noise suppression design features, on a selected version of the DC-8 airplane was studied. The DC-8-61 was selected. A new pylon would be required, but no other major structural changes would be necessary. The present wing is satisfactory. A powered elevator system would be required. The retrofit of the quiet engine would result in improved airplane takeoff and payload-range performance. However, direct operating costs would be increased by about 50 percent. Author

N69-35792*# Northern Research and Engineering Corp., Cambridge, Mass.

THE ANALYSIS OF GEOMETRY AND DESIGN-POINT PERFORMANCE OF AXIAL-FLOW TURBINES USING SPECIFIED MERIODIONAL VELOCITY GRADIENTS. PART 2: DESIGN EXAMPLES

F. K. Lenherr and A. F. Carter 20 Aug. 1969 168 p refs

(Contract NAS3-12419)

(NASA-CR-72585; NREC-1147-2) Avail: CFSTI CSCL 21E

This report is the second part of a two-part report documenting the development and subsequent application of a computer program for the design of axial-flow turbines. The report presents the results of a general investigation of the effects of changes in the meridional velocity distributions specified at stator and rotor exits. These results are intended to provide future users of the program with some guidance in choosing suitable values of this new analysis variable. The report also presents the results of a specific investigation of the geometry and design-point performance of six multistage turbines which satisfy a selected design requirement. The six turbines consist of five-, four-, and three-stage versions of an ip spool at each of two maximum tip diameters. The performance predictions show a 6.0 per cent drop in total-to-total efficiency as the number of stages is reduced from five to three at the larger tip diameter, and a 4.1 per cent drop for the same reduction at the smaller tip diameter. For the two most highly loaded designs, the total-to-total efficiency of the smaller spool was 2.4 per cent higher than that of the original tip diameter design. Author

N69-35818# Lockheed Missiles and Space Co., Sunnyvale, Calif.

INVESTIGATION OF STREAM INTERACTION DURING GAS INJECTION INTO THE SUPERSONIC PART OF AN AXISYMMETRIC LAVAL NOZZLE

B. S. Vinogradov and Z. G. Shaikhutdinov [1968] 7 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Tekh. Jubilee (USSR), no. 40, 1967 p 94-99

Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Research was carried out on a special, high pressure, supersonic installation by utilizing a model of an axisymmetrical conical supersonic nozzle. During tests, the pressure varied in the receiver ahead of the nozzle. An analysis of experimental data shows that the picture flow interaction during axisymmetric interaction is qualitatively no different than the plane case. In principle, new phenomena associated with tip effects occur in nonsymmetrical injection. Experimental results of this injection are reported. Author

N69-35840*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

RESEARCH AND ADVANCED DEVELOPMENT, VOLUME 2: OART Semiannual Review, 1 Jul. - 31 Dec. 1968

15 Feb. 1969 739 p refs

(Contract NAS7-100)

(NASA-CR-105461; JPL-701-23-Vol-2) Copyright. Avail: CFSTI CSCL 21C

All supporting research and technology in progress at the Jet Propulsion Laboratory during the period July 1 to December 31, 1968, under the direction of the JPL Office of Research and Advance Development, for the NASA Office of Advanced Research and Technology are reviewed. The work units are arranged in numerical sequence by NASA code in each subject section. The research and advanced development results published during this report period are listed under each work unit. Author

N69-35847*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DESIGN, DEVELOPMENT, AND TESTING OF A 1000 POUND (4450 N) THRUST FLOX-PROPANE ABLATIVE ROCKET ENGINE

Donald A. Peterson, Jerry M. Winter, and Albert J. Pavli Washington Sep. 1969 21 p refs

(NASA-TM-X-1873) Avail: CFSTI CSCL 21H

A pressure-fed liquid FLOX-liquid propane rocket engine was designed and test fired at 100 psia (690 kN/m^2) chamber pressure and 1000 pounds (4450 N) thrust. A 137 element oxidant-fuel-oxidant triplet injector produced a characteristic exhaust velocity efficiency of 95.2 percent (96.1 percent corrected) at an O/F of 4.5. The injector was successfully scaled from a 150-pound thrust design. A long run capability was demonstrated by firing an ablative graphite cloth/phenolic thrust chamber for about 200 seconds total time with a throat area change less than ±4 percent. Author

N69-35985# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Stuttgart (West Germany). Institut für Raketentreibstoffe.

PROGRESS IN THE DEVELOPMENT OF HIGH-ENERGY LITHERGOLIC PROPULSION SYSTEMS [FORTSCHRITTE IN DER ENTWICKLUNG HOCHENERGETISCHER LITHERGOLTRIEBWERKE]

Roger Lo *In its* DVL News, No. 39 Mar. 1969 p 460-461 In GERMAN (See N69-35976 20-34)
Avail: CFSTI

New lithergolic propulsion systems are described in which beryllium-oxygen and lithium-fluorine propellants are burned. Special attention is given to questions of nozzle heat resistance and the burning chamber geometry. ESRO

N69-35994*# Aerojet-General Corp., Sacramento, Calif. Propulsion Div.
DEVELOPMENT OF COST-OPTIMIZED INSULATION SYSTEM FOR USE IN LARGE SOLID ROCKET MOTORS. VOLUME 1, TASK 1: SURVEY AND SCREENING Final Report
B. A. Simmons and D. L. Nachbar Aug. 1969 148 p refs
(Contract NAS3-11224)
(NASA-CR-72581) Avail: CFSTI CSCL 21H

Twenty insulation materials, including four pressure-cured, six trowelable, five castable, and five sprayable, were evaluted for composite tensile strength/modulus, density, ambient pot life, viscosity build-up, bond line tensile/shear, water absorption, thermal diffusivity, thermal conductivity, heat capacity, heat of combustion and thermogravimetric properties. Three 20-in.-dia heavyweight motor tests were conducted to determine the relative erosion resistance of the candidate materials. The motors operated at 840 psia over a web for a burning duration of 17.6 sec. Six candidate material specimens, plus V-44 and V-61 control specimens, were evaluated in each motor. Initial Mach numbers and material thickness losses were obtained from pre- and posttest profile measurements. Plots of material thickness loss rates as a function of Mach numbers provided a comparison of the erosion resistance of each material relative to the erosion performance of the V-44 control. A tradeoff rating yielded a recommendation of ten materials, plus the specified V-44 control, for further evaluation. Author

N69-35995*# Aerojet-General Corp., Sacramento, Calif. Propulsion Div.
DEVELOPMENT OF COST-OPTIMIZED INSULATION SYSTEM FOR USE IN LARGE SOLID ROCKET MOTORS. VOLUME 2, TASK 2: PROCESS EVALUATION Final Report
B. A. Simmons and D. L. Nachbar Aug. 1969 62 p
(Contract NAS3-11224)
(NASA-CR-72582) Avail: CFSTI CSCL 21H

Nine candidate materials previously selected were installed into various sections of a 54-in.-dia demonstration test chamber. A Polaris A-2P first stage steel case was prepared for this purpose. Process evaluations with IBT-106 showed this material and process to be a prime consideration for large motor sidewall insulation and propellant boot applications. Troweled IBT-100 and TI-H7048 and cast IBC-111 and 40SD-80 provided adequate dome insulation. Demonstrations of the sprayable materials, IBS-107 and IBS-109, as sidewall insulation indicated that more development work is necessary before spray application can be adapted for use in large motors. Author

N69-35996*# Aerojet-General Corp., Sacramento, Calif. Solid Rocket Div.
DEVELOPMENT OF COST-OPTIMIZED INSULATION SYSTEM FOR USE IN LARGE SOLID ROCKET MOTORS. VOLUME 3, TASK 3: MATERIAL PERFORMANCE DETERMINATION Final Report
B. A. Simmons and D. L. Nachbar Aug. 1969 110 p refs
(Contract NAS3-11224)
(NASA-CR-72583) Avail: CFSTI CSCL 21H

The candidate materials selected previously were evaluated in five solid-propellant test motors, using V-44 rubber as the control material. The 20-in.-dia test motors operated 832 to 854 psia over a web for a burning duration of 17.3 to 17.6 sec. Two candidate material specimens, plus a V-44 control specimen, were tested in each motor. Initial Mach numbers and material thickness loss were obtained from pre- and posttest profile measurements. Plots of material thickness loss rates as a function of Mach numbers provided a performance comparison of each material relative to V-44. Results indicate that IBT-100, IBT-106, USR-3800, IBC-111, and IBS-107 performed better than V-44. The performance of TI-H7048 was equivalent to that of V-44, while IBC-101, IBS-109, 40SD-80, and Avcoat II exhibited erosion resistance poorer than that of V-44. Thermal behavior model preparation showed that analytical treatment of internal insulation thermal response not only provides realistic estimates of insulation material performance, but also affords a means of interpreting experimental erosion data and scaling these results to large motors. Author

N69-35997*# Aerojet-General Corp., Sacramento, Calif. Solid Rocket Div.
DEVELOPMENT OF COST-OPTIMIZED INSULATION SYSTEM FOR USE IN LARGE SOLID ROCKET MOTORS. VOLUME 4, TASK 4: 260 IN. DIA MOTOR INSULATION SYSTEM DESIGN AND PROCESS PLAN Final Report
B. A. Simmons and D. L. Nachbar Aug. 1969 93 p refs
(Contract NAS3-11224)
(NASA-CR-72584) Avail: CFSTI CSCL 21H

Preliminary designs based on observed material erosion rates were prepared for eight potential 260-in.-dia full-length motor insulation systems. Weight, production costs, and tooling concepts were derived. Trowelable IBT-100-insulated domes and nozzle and trowelable IBT-106-insulated sidewall and propellant boots were the selected insulation system. An alternative system, which incorporated USR-3800 in the aft dome and nozzle, was recommended. A requirement/capability analysis was conducted on the selected system. A material performance standard deviation of 15.1% and an allowable failure probability of 10^{-6} were the key parameters. The most significant parameter controlling required insulation thickness, and subsequently total system weight, was the material performance standard deviation. The observed V-44 material performance standard deviation was used for this analysis. The following are the final 260-FL motor IBT-100/IBT-106 insulation system design characteristics: total weight, 44,645 lb; performance standard deviation, 15.1%; allowable probability of failure, 10^{-6}; allowable propellant defect size, 8 in. dia; estimated production cost per motor, $141,684; and estimated initial tooling cost, $75,900. These characteristics are compared with those of the V-44/V-45 insulation system. Author

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N69-35334# Turin Univ. (Italy). Istituto di Fisica Generale.
RESULTS ON HIGH ENERGY COSMIC RAY VARIATIONS [RISULTATI SULLE VARIAZIONI DEI RAGGI COSMICI DI ALTISSIMA ENERGIA]
G. Cini Castagnoli, E. Antonucci, and M. A. Dodero Feb. 1969 43 p refs In ITALIAN Sponsored by Consiglio Nazl. delle Ric.
Avail: CFSTI

Important results obtained by measuring cosmic rays at underground stations are reviewed and a list of such stations and their characteristics is given. The results of continuous

measurements of the muon flux intensity were used to study the following four types of problems: a) atmospheric effects, b) solar modulation effects on high energy galactic cosmic rays ($E \leq 50$ GeV), c) possible stellar variations, d) Forbush decreases and solar effects and their association with interplanetary magnetic field variations. ESRO

N69-35468*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.

BALLOON OBSERVATIONS OF HIGH ENERGY X-RAY SOURCES IN THE REGION OF THE GALACTIC CENTER

W. H. G. Lewin, G. W. Clark, M. Gerassimenko, and W. B. Smith [1969] 13 p refs

(Grant NGR-22-009-015; Contract AT(30-1)-2098)

(NASA-CR-105308; CSR-P-69-18) Avail: CFSTI CSCL 04A

The positions and spectra of four high energy X-ray sources near the galactic center are derived from balloon observations made in October 1967 in the enemy range above 20 keV. Author

N69-35576 Centre d'Etudes et de Recherches en Technologie Spatiale, Toulouse (France).

DETERMINATION OF RADIATION DOSES IN SPACE [CALCUL DES DOSES DE RADIATION DANS L'ESPACE]

C. Elbaz ed., J.-F. Faugère ed., and A. Lebeau ed. [1968] 390 p refs Partly in FRENCH and partly in ENGLISH Proc. of the CNES/CERTS Journées Européennes, Toulouse, 1968 Prepared jointly with CNES

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Conference papers on particle motion, methods of radiation measurement, and ground simulation of radiation are presented. For individual titles see N69-35576 20-29 through N69-35599 20-16

N69-35577 Royal Inst. of Tech., Stockholm (Sweden).

TRANSPORT AND ACCELERATION OF RADIATION BELT PARTICLES

C.-G. Fälthammar *In* CERTS Determination of Radiation Doses in Space [1968] p 5-28 refs (See N69-35576 20-29)

Copyright Avail: Issuing Activity

There is now general agreement that the ultimate source of almost all the energetic particles in the radiation belts is the solar wind. The paper gives the basis of this conclusion and explains the mechanisms by which solar-wind particles become radiation belt particles. Two things are required: a small fraction of the solar wind particles must be brought deep into the magnetosphere, and these particles must be energized from their initial low energy to the high energies found in the radiation belts. Both of these results are achieved as a consequence of time-dependent electric and magnetic disturbance fields. The physical characteristics of the processes involved and the mathematical formalism used to analyze them is presented. Author (ESRO)

N69-35578 Max-Planck-Institut für Physik und Astrophysik, Munich (West Germany). Institut für Extraterrestrische Physik.

LOSS PROCESSES AND EQUILIBRIUM DISTRIBUTION OF TRAPPED PARTICLES

G. Haerendel *In* CERTS Determination of Radiation Doses in Space [1968] p 31-38 refs (See N69-35576 20-29)

Copyright Avail: Issuing Activity

An intimate relation between the trapped particle population and the hydromagnetic wave field interacting with the particles is stressed. The theory is illustrated by a sand-box model for the operation of the dominant process, the scattering of mirror points along lines of force. ESRO

N69-35580 Centre National de la Recherche Scientifique, Verrières-le-Buisson (France). Service d'Aéronomie.

DESCRIPTION OF RADIATION BELTS (STEADY TRAPPING ZONES) [DESCRIPTION DES CEINTURES DE RADIATIONS (ZONES DE PIEGEAGE STABLE)]

J.-F. Crifo *In* CERTS Determination of Radiation Doses in Space [1968] p 49-84 refs In FRENCH; ENGLISH summary (See N69-35576 20-29)

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An introductory survey of the stable trapping zone inside the earth's magnetosphere ('radiation belts') is given. Some results obtained by applying the so-called 'adiabatic approximation' to the motion of charged particles in the earth's magnetic field are recalled. In this way one may trace the boundary of the stable trapping zone, and define a coordinate system suitable for organizing the experimental data. The second part is devoted to a brief description of the stationary energetic proton and energetic electron belts, neglecting the time variation. Some indications about the lower energy particles as well as heavy ions are also given. Finally some experimental data are presented to give an idea of the time variation of these particles. Author (ESRO)

N69-35581 Centre d'Etude Spatiale des Rayonnements, Toulouse (France).

AURORAL PRECIPITATIONS AND SOLAR FLARES [PRECIPITATIONS AURORALES ET ERUPTIONS SOLAIRES]

H. Reme' *In* CERTS Determination of Radiation Doses in Space 1969 p 85-116 refs In FRENCH; ENGLISH summary (See N69-35576 20-29)

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The following two types of intense and sporadic phenomena in space radiation are discussed: a) Auroral phenomena caused by electron and proton precipitation which give rise to light emission, magnetic perturbations, radiowave absorption, VLF emission, and X-ray precipitation detected with balloon apparatus in well delimited zones, which may move according to local time. Auroral particles, whose origin is still unknown, probably arise from solar wind-magnetosphere interactions. b) During intense solar flares there is an ejection of high energy particles, mainly protons and alpha particles whose fluxes are often considerable and a plasma cloud with energy up to 10^{32} ergs. After diffusion in space, these particles give intense geomagnetic effects at high altitudes. Author (ESRO)

N69-35582 European Space Technology Center, Noordwijk (Netherlands).

COSMIC RAY CUT-OFF ENERGY AT SYNCHRONOUS DISTANCE

H. Martinides and A. Taroni *In* CERTS Determination of Radiation Doses in Space 1968 p 117-128 refs (See N69-35576 20-29)

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The high energy particle environment of a synchronous satellite is determined by the flux of high energy solar particles and cosmic rays and further by the geomagnetic cut-off energy. This threshold energy is a function of the direction of the arriving particles and the position of the satellite within the magnetosphere. Particles with energies below the cut-off energy are excluded by the action of the geomagnetic field. The geomagnetic cut-off energy for synchronous distance has been computed by the trajectory tracing method employing the magnetospheric model of Beard and Mead. This model includes the effect of the interaction of the solar wind with the geomagnetic field, which causes the formation of the boundary of the geomagnetic field. This effect is not accounted for in the theory of Störmer. The method of computation is outlined and typical results obtained by this method are discussed. These results are compared with the Störmer theory. Author (ESRO)

N69-35586* Oak Ridge National Lab., Tenn.
CALCULATIONS OF THE RADIATION HAZARD DUE TO EXPOSURE OF SUPERSONIC AIRCRAFT TO SOLAR FLARE PROTONS
M. Leimdorfer, R. G. Alsmiller, Jr., and R. T. Boughner *In* CERTS Determination of Radiation Doses in Space 1968 p 173–186 refs Sponsored by NASA (See N69-35576 20-29)
Copyright Avail: Issuing Activity CSCL 01C

Monte Carlo transport calculations have been carried out to estimate the dose travelers in supersonic aircraft received from a typical spectrum of solar flare protons. The dose, from both primary protons and secondary particles, as a function of depth in a tissue slab placed at various depths in the atmosphere, has been obtained. The incident spectrum is broken into eight energy regions and the dose from the incident protons in each of these regions is presented. Author (ESRO)

N69-35587 Centre d'Enseignement et de Recherches de Médecine Aé,onautique, Paris (France).
CONSIDERATIONS CONCERNING RADIATION DOSAGE IN VIEW OF QUANTIFYING THE BIOLOGICAL EFFECTS IN THE CASE OF SUPERSONIC TRANSPORT [CONSIDERATIONS RELATIVES AUX CALCULS DES DOSES DE RADIATIONS EN VUE DE LA QUANTIFICATION DES EFFETS BIOLOGIQUES DANS LE CAS DU TRANSPORT SUPERSONIQUE]
L. Miro, A. Pfister, G. Deltour, and R. Kaiser *In* CERTS Determination of Radiation Doses in Space 1968 p 187–194 refs In FRENCH; ENGLISH summary Prepared jointly with Centre de Rech. Nucl. and Compagn. Gen. d'Elec. (See N69-35576 20-29)
Copyright Avail: Issuing Activity

In order to resolve the problem of the biological effects of cosmic ionizing particles as found in supersonic commercial aircraft at high-cruising altitudes, it is necessary to take into account certain gaps in our physical (particle characteristics) and biological knowledge, and also to reconsider the classical notion of radiation dose computation. Following this idea, various balloon experiments have been carried out with the help of nuclear emulsions and biological preparations. Results are still fragmentary, but it is obvious that a large amount of additional research work is still necessary in close collaboration with teams of physicians and biologists. Author (ESRO)

N69-35591 Centre National de la Recherche Scientifique, Verriè,es-le-Buisson (France). Service d'Aéronomie.
PRELIMINARY STUDY OF D-2 EXPERIMENT [ETUDE PRELIMINAIRE A L'EXPERIENCE D-2]
J. Huriet, J. Crifo, and P. Coufleau *In* CERTS Determination of Radiation Doses in Space 1968 p 243–260 In FRENCH; ENGLISH summary (See N69-35576 20-29)
Copyright Avail: Issuing Activity

The dose received by a satellite D-2 during its mission is determined from a model of the distribution of electrons and protons. Starting from this prediction some examples of the aging of different materials and sub-systems, e.g. photomultipliers, high-tension voltage generators, photodiodes, optical windows, are presented. Author (ESRO)

N69-35721*# Massachusetts Inst. of Tech., Cambridge. Dept. of Physics.
REVIEW OF OBSERVATIONAL RESULTS ON GAMMA RAY BACKGROUND
G. W. Clark, G. P. Garmire (Calif. Inst. of Tech.), and W. L. Kraushaar (Wis. Univ.) [1969] 20 p refs Prepared jointly by Mass. Inst. of Tech., Calif. Inst. of Tech., and Wis. Univ.
(Contract NAS5-3205; Grants NGR-22-009-015, NGL-05-002-007, NGR-50-002-044)
(NASA-CR-105310) Avail: CFSTI CSCL 04A

Recent observations in the X- and gamma ray region of the electromagnetic spectrum have given strong evidence for the existence of an extragalactic intensity with a slowly steepening power law spectrum in the region 10^3 to 10^8 eV. Improved data from the OSO-3 high energy gamma ray detector are in agreement with earlier published reports, and suggest that the gamma rays from high galactic latitudes have a softer spectrum than those from the galactic plane. Author

N69-35729# Turin Univ. (Italy). Istituto di Fisica Generale.
PROPOSAL FOR A CORE SELECTOR FOR EXTENSIVE AIR SHOWERS [PROPOSTA PER UN SELEZIONATORE DI ASSI DI EAS]
G. Bosia [1969] 23 p refs In ITALIAN Sponsored by Consiglio Nazl. delle Ric
Avail: CFSTI

A core selector for extensive air showers would be sensitive to the particular conditions existing in the vicinity of the axes of the shower and could be used to investigate the particular showers. The proposed method is based on the hypotheses that high energy electrons should be present in the core region and that these electrons would multiply on passing through a lead layer. The core selector could be used for research on high energy particles and as a 'master' for a set of detectors. ESRO

N69-35734*# Volt Information Sciences, Inc., Washington, D.C.
COSMIC RAYS AND DYNAMICS OF THE SOLAR WIND
I. V. Derman and L. I.Dorman Greenbelt, Md. NASA. Goddard Space Flight Center 20 Aug. 1969 10 p Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 8, no. 5, 1968 p 817–821
(Contract NAS5-12487)
(NASA-CR-105269; ST-CR-NP-10784) Avail: CFSTI CSCL 04A

When investigating the propagation of cosmic rays in interplanetary space, solar wind is considered as given and independent of cosmic rays. It is shown that, considering the problem rigorously, one must take into account the inverse action of cosmic rays on the fluxes of solar plasma, which is materialized by way of magnetic fields. The integral–differential equation is derived, which describes the interaction of solar wind with cosmic rays, taking into account the intensity modulation and the deceleration of solar wind by cosmic rays. Author

N69-35736*# Naval Aerospace Medical Inst., Pensacola, Fla. Naval Aerospace Medical Center.
RADIATION MEASUREMENTS AT SUPERSONIC TRANSPORT ALTITUDE WITH BALLOON-BORNE NUCLEAR EMULSIONS
Hermann J. Schaefer 2 May 1969 19 p refs Sponsored by NASA
(NASA-CR-105375; NAMI-1068) Avail: CFSTI CSCL 04A

On a balloon flight out of Fort Churchill, Canada which floated at 65,000 feet for 19 hours during solar maximum at a quiet sun (22 August 1968), radiation packs were flown, and each contained a single K.2 nuclear emulsion sheet embedded in tissue equivalent moderating material. Because of its low sensitivity, the K.2 emulsion recorded only the proton flux from zero to 20 MeV, yet with excellent linear energy transfer (LET) resolution. Track and grain count analysis furnished an absorbed dose rate of 0.17 millirad/hour and a dose equivalent rate of 0.49 millirem/hour. The

grain count indicated that as much as 50 per cent of the dose equivalent is due to protons of less than 0.9 MeV. Presumably, the bulk of these low energy protons are neutron recoils. The results emphasize that accurate measurement of the galactic dose equivalent at SST altitude requires instrumentation with high resolution of the LET closely up to the Bragg peak of protons and responding to particles of a few micra residual range in tissue.
Author

N69-35882*# California Univ., Berkeley. Space Science Lab.
INTERPLANETARY SECTOR STRUCTURE IN THE RISING PORTION OF THE SUNSPOT CYCLE
John M. Wilcox and David S. Colburn 4 Feb. 1969 16 p refs Submitted for publication *Its* Ser. 9, Issue 68
(Grants NGR-05-003-230; NSG-243; NSF GA-1319; Contract Nonr 3656(26); Proj. NR-021-101)
(NASA-CR-105389) Avail: CFSTI CSCL 03B

The interplanetary sector structure during the rising portion of the sunspot cycle in 1966 and 1967 has been investigated. The sector pattern is often quasi-stationary for a few rotations, followed by an appreciable change in the next rotation. When a sector boundary passes the earth geomagnetic geomagnetic activity tends to increase, an effect rather similar to that observed near sunspot minimum. The recurrence period of the interplanetary field during the interval investigated was 27.5.
Author

N69-35895*# General Electric Co., Schenectady, N.Y. Research and Development Center.
STUDY OF HIGH RESOLUTION PLASTIC TRACK DETECTORS OF HEAVY COSMIC RAYS Final Report
P. B. Price, R. L. Fleischer, and A. A. Miller Aug. 1969 63 p refs
(Contract NAS9-8868)
(NASA-CR-101881)

Effects of ionizing radiation on surface etching rates of plastic films as function of irradiation dose are evaluated by weight loss per unit area after the processed films are dried in a vacuum. Of the numerous plastics studied, Lexan polycarbonate in 250 μ thick sheets and Kodacel unplasticized cellulose triecetate in 125μ sheets show the following acceptable qualities: (1) uniformity of response; (2) absence of flaws that etch preferential; (3) retention of latent tracks; (4) outstanding optical quality of etched tracks; (5) increased etch rates at high ionization rates; (6) ultimate shelf life; and (7) sensitivity and resolving power for relativistic particles from $Z \approx 30$ up to at least 100. None of the cellulose nitrates and polyesters studied perform as well as the above mentioned plastics.
G.G.

N69-35916# European Space Research Lab., Noordwijk (Netherlands).
DESCRIPTION OF EXPERIMENT R-74, SARDINIA, JULY 1966: INVESTIGATION OF NEUTRON ALBEDO
D. E. Page Aug. 1966 7 p refs
(ESRO-SN-59-ESLAB) Avail: CFSTI

The aim of this experiment is to determine the densities of atmospheric neutrons with energies from thermal (about 0.04 eV) up to about 20 MeV in a height band between 40 km and 60 km. Brief mention is made of the scientific reasons for the experiment and of previous measurements from balloons at heights approaching 40 km. The method to be used in the present experiment is to carry the detector up to about 60 km by means of a Belier rocket and then to eject it attached to a parachute. It will then be possible to obtain measurements as it drifts from 60 km down to 40 km which can be compared with the results obtained from balloons. The package will be tracked by radar. A description follows of the experimental sensor which will be used to count the neutrons; this employs the Phoswich technique of pulse shape discrimination.
Author (ESRO)

N69-35952# European Space Research Inst., Frascati (Italy).
GEOMAGNETIC MICROPULSATIONS AND THE LOCATION OF THE MAGNETOSPHERIC BOUNDARY
N. D'Angelo May 1969 5 p refs Submitted for publication
Avail: CFSTI

Recent investigations seem to reveal difficulties for the hypothesis that the period of continuous geomagnetic micropulsations are related to the dimensions of the magnetosphere. By taking the minimum Alfvén velocity as the relevant value, i.e. the velocity just inside the magnetospheric boundary, assuming that the plasma density is independent of R_m and analyzing the total magnetic field inside the boundary, it is shown that the apparent difficulties can be resolved.
Author (ESRO)

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N69-34613*# Arizona Univ., Tucson.
COMMUNICATIONS OF THE LUNAR AND PLANETARY LABORATORY, VOLUME 8, PART 2
1969 66 p refs Sponsored by NASA and NSF *Its* Commun. Nos. 133–141
(NASA-CR-103992) Avail: CFSTI

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3. POLARIZATION-ALBEDO RELATIONSHIP FOR SELECTED LUNAR REGIONS S. F. Pellicori p 73–74 (See N69-34618 20-30)

4. TERRESTRIAL, LUNAR AND INTERPLANETARY ROCK FRAGMENTATION (SYNOPSIS) W. K. Hartmann p 75–79 refs (See N69-34617 20-30)

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9. STELLAR PHOTOMETRIC DATA FOR SIX DIFFERENT PHOTOCATHODE MATERIALS AND THE SILICON DETECTOR F. F. Forbes and R. J. Mitchell p 99–119 refs (See N69-34622 20-30)

N69-34614*# Arizona Univ., Tucson.
CRATER STATISTICS NEAR THE FLAMSTEED P RING

R. Fryer and C. Titulaer *In its* Commun. of the Lunar and Planetary Lab., vol. 8, pt. 2 1969 p 51–61 refs Prepared for JPL (See N69-34613 20-30)
(Contracts NAS7-100; JPL-952166)
Avail: CFSTI CSCL 03B

Previous work on the population curves and crater distribution in the vicinity of *Surveyor I* is reviewed and extended. A total-population curve is derived for craters ranging in size from centimeters to kilometers. Comparison is made with *Ranger* data covering an equivalent diameter range. The floor of the low ring, Flamsteed P is found to be unusually young, younger than the surrounding mare; this is consistent with the recent hypotheses which regard the ring as a recent extrusive structure. Author

N69-34615*# Arizona Univ., Tucson.
CRATER OVERLAP ON THE NEAR-SIDE OF THE MOON
Chriet Titulaer *In its* Commun. of the Lunar and Planetary Lab., vol. 8, pt. 2 1969 p 63–72 refs (See N69-34613 20-30)
(Grant NGR-03-002-174)
Avail: CFSTI CSCL 03B

An investigation of the overlap of craters on the front side of the moon shows a well-defined anomalous area around Tycho. This Tycho association of craters may have originated as a result of the collision of a cometary shower, the nucleus of which formed Tycho itself. Alternative explanations are also considered. No full explanation is possible without additional research. Author

N69-34616*# Arizona Univ., Tucson.
POLARIZATION-ALBEDO RELATIONSHIP FOR SELECTED LUNAR REGIONS
S. F. Pellicori *In its* Commun. of the Lunar and Planetary Lab., vol. 8, pt. 2 1969 p 73–74 (See N69-34613 20-30)
Avail: CFSTI CSCL 03B

Polarization measurements were performed at several wavelengths on pure examples of maria, highlands and mountains. It was found that the different topographies do not obey the same $P(\lambda)$ law. This suggests differences in particle sizes or compositions on the various topographies. Author

N69-34618*# Arizona Univ., Tucson.
GROWTH OF ASTEROIDS AND PLANETESIMALS BY ACCRETION
William K. Hartmann *In its* Commun. of the Lunar and Planetary Lab., vol. 8, pt. 2 1969 p 81–85 refs (See N69-34613 20-30)
(Contract NSR-12-001-019; Grant NGL-03-002-002)
Avail: CFSTI CSCL 03B

The basic theory of the accretion process, while applicable to planets generally, is applied here to the asteroids as examples. The approach velocity among early asteroidal particles in the solar nebula is estimated to be of the order 1×10^4 cm/sec. Asteroids could grow to observed radii in this case in 10^8 years, assuming efficient sticking (earliest growth may have been by another, non-accretionary process). The overabundance of the largest asteroids ($d \geq 300$ km) is attributed to two factors: the capture cross-section begins to rise steeply at diameter about 140 km, and the asteroids become stable against mass loss by even the highest-velocity impacts at diameter roughly 350 km. Larger bodies would grow rapidly, accounting for the apparent overabundance of large asteroids. It is suggested that the previously reconstructed, mass distribution with the three largest asteroids overabundant, was frozen when the growth process was interrupted, perhaps by disruption of the solar nebula. Approach velocities have increased since the formation of the planets to the present value of a few km/sec, and consequently asteroids smaller than about 300-km diameter have eroded during most of solar-system history. Author

N69-34619*# Arizona Univ., Tucson.
INFRARED OBSERVATIONS OF A PREPLANETARY SYSTEM
Frank J. Low and Bruce J. Smith *In its* Commun. of the Lunar and Planetary Lab., vol. 8, pt. 2 p 87–89 refs (See N69-34613 20-30)
Avail: CFSTI CSCL 03B

R Monocerotis, the twelfth magnitude object at the head of Hubble's Variable Nebula, and other infrared-emitting objects are viewed as proto-planetary systems consisting of a contracting central star and surrounding dust envelope. The infrared observations are extended to a 20 μ wavelength and agree well with a model in which thick circumstellar dust absorbs and re-radiates the energy produced by a luminous central object. Author

N69-34620*# Arizona Univ., Tucson
THE INFRARED SPECTRUM OF THE NML CYGNUS OBJECT
H. L. Johnson *In its* Commun. of the Lunar and Planetary Lab., Vol. 8, Pt. 2 1969 p 91–95 refs (See N69-34613 20-30)
Avail: CFSTI CSCL 03B

An infrared spectrum from 1.4 μ (7000 cm^{-1}) to 4.0 μ (2500 cm^{-1}) was obtained for the NML Cygnus infrared star. A rapid-scanning Michelson interferometer was used. The structure of the CO bands around 4300 cm^{-1} indicates a temperature of 2000°-2500° K. As before, a large infrared excess, compared with that of giants of the same temperature, was found. A broad absorption at 3300 cm^{-1} (3.03 μ) was found; this absorption may be due to interstellar ice. Author

N69-34622*# Arizona Univ., Tucson.
STELLAR PHOTOMETRIC DATA FOR SIX DIFFERENT PHOTOCATHODE MATERIALS AND THE SILICON DETECTOR
F. F. Forbes and R. I. Mitchell *In its* Commun. of the Lunar and Planetary Lab., vol. 8, pt. 2 1969 p 99–119 refs (See N69-34613 20-30)
(Contract NSR-03-002-048)
Avail: CFSTI CSCL 03A

The photodetector responses to the radiant energy incident on the earth's atmosphere from the 964 brightest stars north of declination −20° are presented for the S-1, 4, 11, 17, and 20 and Bialkali photocathode materials and for the silicon detector. The computations for these data are based on recent 13-color narrow-band filter photometry. Photodetector response data for 67 navigational stars, based on existing UBVRIJ photometry for stars south of declination −20°, are also included. Author

N69-34629*# Arizona Univ., Tucson. Steward Observatory.
A SYSTEM FOR THE STUDY OF THE DETECTION OF FAINT ASTRONOMICAL SIGNALS
William G. Tifft 15 Apr. 1969 44 p
(Grant NGR-03-002-032)
(NASA-CR-104097; T-69-15) Avail: CFSTI CSCL 03A

A system was fabricated to investigate the detection of faint images by using an artificial star and sky pattern formed under widely variable controlled conditions. These conditions include a variety of controls on the detector environment as well as image parameters. Author

N69-34633*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROCEEDINGS OF THE SYMPOSIUM ON OBSERVATION, ANALYSIS, AND SPACE RESEARCH APPLICATIONS OF THE LUNAR MOTION

J. Derral Mulholland, ed. 15 Apr. 1969 56 p refs Symp. held at Boeing Sci. Res. Labs., Seattle, 19 Aug. 1968
(Contract NAS7-100)
(NASA-CR-103993; JPL-TR-32-1386) Avail: CFSTI CSCL 03A

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5. AFCRL COMPUTER PROGRAMS FOR THE PHYSICAL EPHEMERIS OF THE MOON D. H. Eckhardt (AFCRL, Bedford, Mass.) p 17–24 (See N69-34638 20-30)

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7. LASER RANGING TO OPTICAL RETRO-REFLECTORS ON THE MOON C. O. Alley, G. G. Currie (Md. Univ.), J. E. Faller (Wesleyan Univ.), and P. Bender (Joint Inst. Lab. Astrophys.) p 29–30 (See N69-34640 20-30)

8. NEW CORRECTIONS TO THE LUNAR EPHEMERIS T. C. van Flandern (Naval Obser.) p 31–33 (See N69-34641 20-30)

9. NUMERICAL INTEGRATION OF THE LUNAR MOTION J. D. Mulholland p 35–42 (See N69-34642 20-30)

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11. ET-UT TIME CORRECTIONS FOR THE PERIOD 1627-1860–C F. Martin (Aeron. Chart and Information Center) p 47–51 refs (See N69-34644 20-30)

N69-34634*# Boeing Co., Seattle, Wash. Space Div.
LUNAR ORBITER PHOTO SITE LOCATION
T. J. Hansen *In* JPL Proc. of the Symp. on Obs., Anal., and Space Res. Appl. of the Lunar Motion 15 Apr. 1969 p 1–2 (See N69-34633 20-30)
Avail: CFSTI CSCL 22A

Accuracy in defining the locations of Lunar Orbiter photographs is being increased through improved data analysis techniques. Consistency in the location of surface features photographed during several missions is used as the criterion for judging accuracy of the techniques. Orbit determination, attitude maneuvers, lunar radius, and selenographic coordinate system orientation enter into the investigation. Author

N69-34635*# Boeing Co., Seattle, Wash. Space Div.
STATUS REPORT OF LUNAR ORBITER RESIDUAL STUDY
Gayle D. Barrow and Philip E.Hong *In* JPL Proc. of the Symp. on Obs., Anal., and Space Res. Appl. of the Lunar Motion 15 Apr. 1969 p 3–10 (See N69-34633 20-30)
(Contract NAS1-7954)
Avail: CFSTI CSCL 22A

The difference between the lunar Doppler observed by tracking stations and the Doppler computed are analyzed by evaluating the relationship of residual magnitude to perilune altitude. Data analyses from Lunar Orbiter missions at various orbital inclinations, apolune altitudes, and tracking station-orbit viewing geometries indicate that the residual magnitude is a function of the inverse square of the perilune altitude. It is assumed that perturbing accelerations from lunar surface features could be the cause of the perilune residual problem. G.G.

N69-34636*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A LUNAR MASS DISTRIBUTION
Paul M. Muller and William L. Sjogren *In its* Proc. of the Symp. on Obs., Anal., and Space Res. Appl. of the Lunar Motion 15 Apr. 1969 p 11–12 (See N69-34633 20-30)
Avail: CFSTI CSCL 22A

Lunar Orbiter tracking data have been processed to give a qualitatively consistent gravimetric map of the lunar nearside. While a simplified model was employed, the results indicate that there are large mass concentrations under the lunar ringed maria. These mass concentrations may have important implications for the various theories regarding the evolution of the moon. Author

N69-34637*# International Business Machines Corp., Cambridge, Mass. Center for Exploratory Studies.
THE SHAPE OF THE MOON AS A SURFACE OF HELMERT'S TYPE
Pasquale Sconzo *In* JPL Proc. of the Symp. on Obs., Anal., and Space Res. Appl. of the Lunar Motion 15 Apr. 1969 p 13–16 (See N69-34633 20-30)
Avail: CFSTI CSCL 03A

The function U of the external potential of a planet expanded in zonal, sectorial, and tesseral harmonics up to terms of fourth degree and fourth order is used to form an ellipsoidal figure of the moon. The Helmert type surface function used contains only two coefficients. G.G.

N69-34638*# Air Force Cambridge Research Labs., Bedford, Mass.
AFCRL COMPUTER PROGRAMS FOR THE PHYSICAL EPHEMERIS OF THE MOON
Donald H. Eckhardt *In* JPL Proc. of the Symp. on Obs., Anal., and Space Res. Appl. of the Lunar Motion 15 Apr. 1969 p 17–24 (See N69-34633 20-30)
Avail: CFSTI CSCL 03B

Described is a computer technique for the analytic generation of tables of the physical ephemeris of the moon, and three computer programs which use these tables to provide data relevant to the observation and reduction of observations of the librations of the moon are outlined. A Cartesian coordinate system for the moon is defined whose axes are assumed to be the same as those of the moon's principal moments of inertia. Euler equations for the forced physical librations of the moon are solved for various parameter combinations by digital computer. Author

N69-34639*# Boeing Scientific Research Labs., Seattle, Wash.
OPTICAL TRACKING OF LUNAR SPACECRAFT
H. B. Liemohn *In* JPL Proc. of the Symp. on Obs., Anal., and Space Res. Appl. of the Lunar Motion 15 Apr. 1969 p 25–28 (See N69-34633 20-30)
Avail: CFSTI CSCL 22C

The theory of specular reflection from spacecraft is described and its potential use for improving the lunar ephemeris is discussed. The apparent stellar magnitude of the illumination at earth from a spacecraft mirror near the moon is approximated and plotted as a function of projected area of an equivalent perfect reflector whose image cone divergence is negligible. Theoretical characteristics of a Lunar Orbiter 5 reflector illumination are summarized. Faint reflection photographs from the Lunar Orbiter 5 near the very bright lunar disk confirm the feasibility and brightness estimates of the measuring method. G.G.

N69-34640*# Maryland Univ., College Park.
LASER RANGING TO OPTICAL RETRO-REFLECTORS ON THE MOON

C. O. Alley, Peter Bender (Joint Inst. Lab. Astrophys.), Douglas G. Currie, and J. E. Faller (Wesleyan Univ.) *In* JPL Proc. of the Symp. on Obs., Anal., and Space Res. Appl. of the Lunar Motion 15 Apr. 1969 p29–30 (See N69-34633 20-30)
Avail: CFSTI CSCL 03A

The accuracy with which one can determine the various parameters entering into the lunar orbit theory, the librations, and the location of the reflector with respect to the center of mass is discussed. Author

N69-34641# Naval Observatory, Washington, D.C.
NEW CORRECTIONS TO THE LUNAR EPHEMERIS
Thomas C. Van Flandern In JPL Proc. of the Symp. on Obs. Anal., and Space Res. Appl. of the Lunar Motion 15 Apr. 1969 p 31–33 (See N69-34633 20-30)
Avail: CFSTI CSCL 03A

Corrections to the moon's orbital elements and the constants of the lunar theory constitute the derivation of analytical partial derivatives by differentiation in the Brown lunar theory. Enough terms are retained in each of the partial derivative series to give a validity of 0".01 to the corrected theory and to obtain a set of solution parameters of great accuracy. An altered expression for the time factor introduced a large compensating correction to the mean longitude of the moon. This change in procedure, together with a good many more parameters, gives new more accurate data for the epoch 1958.0 parameters. G.G.

N69-34642*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NUMERICAL INTEGRATION OF THE LUNAR MOTION
J. Derral Mulholland *In its* Proc. of the Symp. on Obs., Anal., and Space Res. Appl. of the Lunar Motion 15 Apr. 1969 p 35–42 (See N69-34633 20-30)
Avail: CFSTI CSCL 03A

Fitted numerical integration of the lunar motion to the lunar theory establishes the nature of the residuals. Obvious amplitude modulations indicate the presence of planetary synodic periods as well as short term variations of approximately 10 day periods. Analysis of an ephemeris incorporating the integral lunar data of the Surveyer seems to confirm gravitational defects in the theory. A shift of the entire lunar ephemeris by $1^s.44$ in the independent argument, time, relative to the planetary ephemerides reduces spacecraft data for station longitudes by some 28 to 30 m in the desired direction. G.G.

N69-34643*# Naval Weapons Lab., Dahlgren, Va.
NUMERICAL INTEGRATION OF THE LUNAR ORBIT
Claus Oesterwinter and Charles J. Cohen *In* JPL Proc. of the Symp. on Obs., Anal., and Space Res. Appl. of the Lunar Motion 15 Apr. 1969 p 43–46 (See N69-34633 20-30)
Avail: CFSTI CSCL 03A

A least squares solution was made for the orbits of the nine major planets and the moon by fitting to optical observations spanning more than 50 years. Out of a total of 21,000 data points, almost 4,000 are lunar observations. All orbits were computed by numerical integration with a step size of $0^d.4$. The solution available today for the planets is believed to be very close to the optimum obtainable with optical data. Author

N69-34644*# Aeronautical Chart and Information Center, St. Louis, Mo.
ET-UT TIME CORRECTIONS FOR THE PERIOD, 1627–1860
Charles F. Martin *In* JPL Proc. of the Symp. on Obs., Anal., and Space Res. Appl. of the Lunar Motion 15 Apr. 1969 p 47–51 refs (See N69-34633 20-30)
Avail: CFSTI CSCL 03A

A combination of corrections to the moon's elements based on the time period 1627 to 1860, in conjunction with modern values gave accurate determinations of the motions of these elements. Example calculations for the secular motion of obliquity of the ecliptic and for node and perigee rates are given. The application of all corrections to observation data reduced the residuals by a factor of approximately two. G.G.

N69-34663*# Arizona Univ., Tucson.
COMMUNICATIONS OF THE LUNAR AND PLANETARY LABORATORY, COMMUNICATIONS NOS. 160–162, VOLUME 9, PART 1
Gerard P. Kuiper, ed. 1969 66 p refs Sponsored by NASA (Grants NsG-161-61; NGR-03-002-091)
(NASA-CR-103990) Avail: CFSTI CSCL 03B

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1. ARIZONA-NASA ATLAS OF INFRARED SOLAR SPECTRUM, REPORT 4 L. A. Bijl, G. P. Kuiper, and D. P. Cruikshank p 1–27 refs (See N69-34664 20-30)

2. ARIZONA-NASA ATLAS OF INFRARED SOLAR SPECTRUM, REPORT 5 L. A. Bijl, G. P. Kuiper, and D. P. Cruikshank p 29–51 refs (See N69-34665 20-30)

3. ARIZONA-NASA ATLAS OF INFRARED SOLAR SPECTRUM, REPORT 6 G. P. Kuiper, A. B. Thompson, L. A. Bijl, and D. C. Benner p 53–63 (See N69-34666 20-30)

N69-34664*# Arizona Univ., Tucson.
ARIZONA NASA ATLAS OF INFRARED SOLAR SPECTRUM, REPORT 4
L. A. Bijl, G. P. Kuiper, and D. P. Cruikshank *In its* Commun. of the Lunar and Planetary Lab., Commun. Nos. 160–162, Vol. 9, Pt. 1 1969 p 1–27 refs *Its* Commun. No. 160 (See N69-34663 20-30)
Avail: CFSTI CSCL 03B

This paper is a continuation of *Comm. LPL* Nos. 123 and 124, covering the interval $\lambda\lambda$ 13138–14707 Å. Part of the spectrum of the 1.4 μ H_2O band taken with the 4-meter spectrometer in flight is included to show the absorption in the spectrometer itself. For purposes of further identification, laboratory spectra of the 1.4 μ H O_2 band are given. Author

N69-34665*# Arizona Univ., Tucson.
ARIZONA NASA ATLAS OF INFRARED SOLAR SPECTRUM, REPORT 5
L. A. Bijl, G. P. Kuiper, and D. P. Cruikshank *In its* Commun. of the Lunar and Planetary Lab., Commun. Nos. 160–162, Vol. 9, Pt. 1 1969 p 29–51 refs *Its* Commun. No. 161 (See N69-34663 20-30)
Avail: CFSTI CSCL 03B

In this report Charts 23-32 of the *Atlas* are given, containing the solar spectrum $\lambda\lambda$12187–17731 Å, obtained from the NASA CV-990 jet at an altitude of 39,000 ft with the LPL 4-meter spectrometer. A 600-lines/mm grating was used, blazed at 1.6 μ. The Michigan Atlas spectra and an LPL laboratory spectrum of the 2 ν_3(1.6 μ) CH_4 band are included for comparison. Author

N69-34666*# Arizona Univ., Tucson.
ARIZONA-NASA ATLAS OF INFRARED SOLAR SPECTRUM, REPORT 6
G. P. Kuiper, A. B. Thompson, L. A. Bijl, and D. C. Benner *In its* Commun. of the Lunar and Planetary Lab., Commun. Nos. 160–162, Vol. 9, Pt. 1 1969 p 53–63 *Its* Commun. No. 162 (See N69-34663 20-30)
Avail: CFSTI CSCL 03B

The solar spectrum as recorded with the LPL S-Spectrometer on the NASA CV-990, using the 1-μ grating (1200 lines/mm) is reproduced. The resolution is about 4 times lower than in the corresponding records obtained with the LPL 4-m spectrometer. Author

N69-34878*# Bellcomm, Inc., Washington, D.C.
THE POLAR TEMPERATURE OF VENUS
William A. Gale and Alan C. E. Sinclair 15 Jan. 1969 10 p refs
(Contract NASw-417)
(NASA-CR-103948; TM-69-1014-3) Avail: CFSTI CSCL 03B

Published results of interferometric and polarization measurements of the microwave radiation from Venus were examined. The 25% polar cooling derived from the interferometric measurement at 10.6 cm was rejected because of the presence of a large systematic error. The polarization measurement at this wavelength indicated some polar cooling, but the uncertainty in the amount of cooling is large. Neither interferometer nor polarization measurements have detected polar cooling at shorter wavelengths. Author

N69-34885*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
THE FIRST LUNAR EXPEDITION [PERVAYA LUNNAYA EKSPEDITSIYA]
A. P. Vinogradov Washington NASA Aug. 1969 3 p refs Transl. into ENGLISH from *Pravda* (Moscow), no. 203, 22 Jul. 1969 p 6
(Contract NASw-1692)
(NASA-TT-F-12572) Avail: CFSTI CSCL 22A

A Pravda correspondent interviews academician A. P. Vinogradov, Vice President of the Academy of Sciences of the U.S.S.R., for an evaluation of the Apollo 11 flight. F.O.S.

N69-34782# National Academy of Sciences—National Research Council, Washington, D.C. National Academy of Sciences Panel.
REVIEW OF THE UNIVERSITY OF COLORADO REPORT ON UNIDENTIFIED FLYING OBJECTS Special Report
Gerald M. Clemence et al Jan. 1969 10 p refs
(Contract F18600-67-C-0071)
(AD-688541; AFOSR-69-1276TR) Avail: CFSTI CSCL 1/2

The AD HOC Committee concurs with the findings of the report of the University of Colorado entitled "Scientific Study of Unidentified Flying Objects," Dr. Edward U. Condon, Scientific Director (see AD-680 975, AD-680 976, and AD-680 977). Panel agrees that a study of UFOS in general is not a promising way to expand scientific understanding of the phenomena, and adds: 'on the basis of present knowledge the least likely explanation of ufos is the hypothesis of extraterrestrial visitations by intelligent beings.' Author (TAB)

N69-34788# Centre National de la Recherche Scientifique, Marseilles (France). Laboratoire d'Astronomie Spatiale
PROGRAM FOR 'ATLAS-ROCKET' EXPERIMENT [PROGRAMME DE L'EXPERIENCE 'ATLAS-FUSEE']
Jun. 1969 28 p In FRENCH
Avail: CFSTI

An account is given of three different experiments to be launched in the third quarter of 1971, to record the magnitudes of some stars in three spectral bands, to compare the ultraviolet background radiation and the ultraviolet radiation of the brightest stars, also to determine the spectral energy distribution of A-star radiation. ESRO

N69-34801# Colorado Univ., Boulder. Lab. for Atmospheric and Space Physics.
DEVELOPMENT, FABRICATION, ASSEMBLY, AND TESTING OF UV ABSORPTION SPECTROGRAPH FOR AEROBEE ROCKET FLIGHT Final Report, 18 Dec. 1964–31 Jan. 1969
William K. Fowler and Vernon L. Stone Feb. 1969 24 p
(Contract AF 19(628)-4961)
(AD-688563; AFCRL-69-0094) Avail: CFSTI CSCL 20/6

The work involves a continuation of the development of rocket-borne UV spectographs to study the solar spectrum in the spectral region below 3000A and to determine the density of atomic oxygen in the earth's atmosphere between 80 and 100 km. A one meter normal incidence spectograph, using a predispersion grating, was developed, fabricated and tested for use on a rocket flight. Laboratory testing showed the spectograph to have the proper characteristics, however, it was found that a prefocussing mirror, when used in place of the grating, produced a higher speed instrument that was more suitable for laboratory use. The unit was sent to AFCRL and is presently being used as a laboratory instrument. A similar instrument was designed and fabricated into the rocket payload that carried a self-contained UV light source to determine the atmospheric absorption. The experiment was flown and it appeared to be a feasible method to obtain the data, but a subsequent mechancial failure after launch precluded any spectographic data or method analysis, as the payload did not separate from the rocket, causing a complete loss of the instrument. Investigation of the properties of reflectivity and transmissivity of (U) thin films in the spectral region provided information for improved and new reflecting and transmitting optics. Author (TAB)

N69-34850*# General Dynamics Fort Worth, Tex.
PLANETARY FLIGHT HANDBOOK. PART 8: JUPITER SWINGBY MISSIONS TO SATURN, URANUS, NEPTUNE, AND PLUTO
Washington NASA Jan. 1969 131 p refs *Its* Space Flight Handbooks Vol. 3
(Contract NAS2-4982)
(NASA-SP-35; Pt. 8) Avail: SOD $1.50; CFSTI CSCL 22A

Trajectory data and related information for outer-planet swingby missions available during the launch periods 1976 through 1983 are presented. Data for two types of missions are included: single-planet (Jupiter) swingbys to Saturn, Uranus, Neptune, and Pluto and multiplanet swingbys composed of sequential encounters with Jupiter, Saturn, Uranus, and Neptune (referred to as grand tour mission). Author

N69-34884*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE RED-SHIFT MAGNITUDE RELATION AND OBSERVATIONAL DATA
Windsor L. Sherman Washington Aug. 1969 26 p refs
(NASA-TN-D-5398) Avail: CFSTI CSCL 03A

The red-shift—magnitude relation for uniform, zero-pressure models of the universe is one of the stronger relationships connecting theory and observation in cosmology. This relationship has been used to determine models for the universe from the observed apparent magnitudes and red shifts of galaxies. The problems associated with the use of the red-shift—magnitude relation to determine a model universe are discussed. In particular, the effects of evolution and selection on the use of the red-shift—magnitude relation are considered. Selection is the tendency of observers to select intrinsically brighter sources for observation as the distance to the sources increases. The results indicate that the red-shift—magnitude relation should be used with caution when determining a model for the universe because the variation of the intrinsic luminosity of sources must be taken into account. Author

N69-34823# Belgian Royal Observatory, Uccle.
COMPLETE STUDY OF THE ELLIPTICAL ORBIT OF THE VISUAL DOUBLE STAR h 3447 EQUALS BDS 836 (TAU SCULPTORIS) [ETUDE COMPLETE DE L'ORBITE ELLIPTIQUE DE L'ETOILE DOUBLE VISUELLE H 3447 EQUALS BDS 836 (TAU SCULPTORIS)]
S. Arend and R. R. de Freitas Mourao 1968 10 p refs In FRENCH *Its* Commun., Ser. A, No. 6
(TN-157) Avail: CFSTI

Tables are presented which cover the orbit variations of the double star, Tau Sculptoris. Eccentricity, dynamic parallax, and the physical characteristics are included in the survey. The measurements were accomplished through trigonometric functions. Results indicate that errors were small after reflection corrections were made. Trans. by E.H.W.

N69-35050# Turku Univ. (Finland). Astronomisch-optisches Forschungsinstitut.
EXACT PHOTOGRAPHIC POSITIONS OF SMALL PLANETS [GENAUE PHOTOGRAPHISCHE POSITIONEN KLEINER PLANTEN]
Hilkka Rantaseppae-Helenius 1967 51 p refs In GERMAN *Its* Informo No. 32
Avail: CFSTI

This catalog contains exact photographic position data for small planets discovered at the astronomical observatory Turku in Finland between August 1938 to May 1939. Planetary positions were obtained by evaluation of three or four comparable stars and their elliptical elements. Transl. by G.G.

N69-35076# Madrid Univ. (Spain).
ABSOLUTE PHOTOMETRY OF GREEN RAY OF ATMOSPHERIC CONTINUUM AT THE ASTRONOMICAL OBSERVATORY OF TEIDE (TENERIFE), FROM JANUARY 1964–JULY 1965 [FOTOMETRIA ABSOLUTA DE LA RAYA VERDE Y DEL CONTINUO ATMOSFERICOS EN EL OBSERVATORIO ASTRONOMICO DEL TEIDE (TENERIFE), DE ENERO DE 1964 A JULIO OF 1965]
Sanchez Martine (Teide Obs., Spain) and R. Dumont (Burdeos Obs.) 1967 22 p refs In SPANISH; ENGLISH summary Presented at the Union Nacl. de Astronomia y Cienc. Afines Submitted for publication
(Pub-60) Avail: CFSTI

The true zenithal brightnesses $Q^{(n)}$ of the green oxygen line and Λ of the atmospheric continuum were computed, based on 364 photoelectric measurements of the polar values Q_p of the 5577 Å and I_p of the 5000 Å brightnesses of the night sky. It was found that the two radiations are fairly correlated in brightness and both show a tendency to a maximum near local midnight. Author

N69-35163*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A PROGRAM PLAN FOR EARTH ORBITAL SPACE ASTRONOMY
J. R. Olivier and H. L. Wolbers (McDonnell-Douglas Astronautics Co., St. Louis, Mo.) May 1969 20 p refs St. Louis, Mo. McDonnell-Douglas Astronautics Co. Presented at the 9th Brit. Interplanet. Soc. European Space Symp., London, 14–16 May 1969
(NASA-TM-X-61793; Douglas Paper-5371) Avail: CFSTI CSCL 03A

Manned space flight offers the opportunity to couple the astronaut/scientist's ability to select and process data and to calibrate, modify and repair instruments with the vantage point for astronomical observations provided by a platform located above the earth's atmosphere. This paper briefly examines the role which manned space flight may play in the 1970–1990 time period in meeting astronomy research needs. The instruments and facilities which appear feasible for that period are described. Author (ESRO)

N69-35202# California Univ., Berkeley. Space Sciences Lab.
MICROWAVE ABSORPTION IN THE JOVIAN ATMOSPHERE
Gerald T. Wrixon 25 May 1969 86 p refs *Its* Ser. 10, Issue 26
(Contract Nonr-222(54))
(AD-688465) Avail: CFSTI CSCL 3/2

Measurements are presented of the microwave radiation from Jupiter in the wavelength range 0.8 - 1.5 cm. Wideband observations indicate a broad absorption feature caused by the pressure broadened microwave spectrum of the ammonia present in Jupiters atmosphere. Spectral line observations show emission features which are interpreted as indicating the presence of a temperature inversion high in the Jovian atmosphere. The measurements are compared with theoretical spectra computed from variations of previously proposed model atmospheres for Jupiter. A new radio telescope was used for the observations and its precise calibration is also described. Author (TAB)

N69-35285*# Volt Information Sciences, Inc., Washington, D.C.
INFLUENCE OF A PLANETARY ATMOSPHERE UPON THE FRESNEL DIFFRACTION OF ULTRASHORT WAVES
V. V. Adrianov Greenbelt, Md. NASA Goddard Space Flight Center 31 Aug. 1969 10 p refs Transl. into ENGLISH from Radiotechn. i Elektron. (Moscow), v. 14, no. 8, 1969 p 1355–1361
(Contract NAS5-12487)
(NASA-CR-104199; ST-PA-EMWP-10864) Avail: CFSTI CSCL 03B

The asymptotic representation is obtained of the attenuation function in the region of Fresnel's penumbra at ultra-short wave diffraction around a planet surrounded by atmosphere. The results are presented of numerical calculations for an exponential profile of the atmosphere. Author

N69-35288# Belgian Royal Observatory, Uccle.
HOW DOES ONE CALCULATE THE ORBIT OF A DOUBLE VISUAL STAR APPARENTLY IMPOSSIBLE TO DETERMINE BY THE THIELE-INNES METHOD (QUES) [COMMENT PARVENIR A CALCULER L'ORBITE D'UNE ETOILE DOUBLE VISUELLE APPAREMMENT IMPOSSIBLE A DETERMINER PAR LA METHODE DE THIELE-INNES (QUES)]
S. Arend and R. R. de Freitas Mourao 33 p refs In FRENCH *Its* Commun., Ser. A, No. 5
(TN-157) Avail: CFSTI

A mathematical hypothesis for the problem of the calculation of the elliptical orbits of double visual stars is demonstrated. In this instance the research is directed to those cases which are not accessible to the Thiele–Innes method. When basic barycentric coordinates data are not available to satisfy the necessary conditions of the Thiele–Innes method, formulas based on the differential calculus are provided which include a correction factor for a plausible solution. Alternately an algorithm series is established to solve the same rectangular coordinates. Three applications of this new approach are provided to demonstrate plausible and implausible resolutions of the calculation. Transl. by M.H.E.

N69-35360# European Space Research Inst., Frascati (Italy).
ELECTROMAGNETIC SPECTRUM OF NP 0532
B. Bertotti, A. Cavaliere (EURATOM), and F. Pacini (Centro Nazl. Ric.) May 1969 8 p refs
Avail: CFSTI

Optical and X-ray emissions from the Crab Nebula pulsar NP 0532 have now been detected and the vectorial acceleration of relativistic electrons is considered as a possible origin of this wide spectral band. It is assumed that the radiating particles are coherently forced to rotate around a star by stellar electromagnetic fields and circle around the lines of force. It is suggested that the radiospectrum is associated with the stellar rotation frequency and the optical and X-rays are related to the gyrofrequency. It is suggested that slow pulsars might emit infrared radiation. Author (ESRO)

N69-35406# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.

TWO ALTERNATIVES FOR THE HISTORY OF THE MOON

H. Alfvén and G. Arrhenius 15 Feb. 1969 24 p refs
(Rept-69-13) Avail: CFSTI

Different models for the early history of the moon and its capture by the earth are discussed. The two hypotheses that the moon has (catastrophic alternative) or has not approached the Roche limit are considered in detail. It is shown that the available data are insufficient for making a choice between them but analysis of the moon's surface may provide an answer. ESRO

N69-35409# Centre National de la Recherche Scientifique, Marseilles (France). Laboratoire d'Astronomie Spatiale.

PROGRAM FOR 'ATLAS-BALLOON' EXPERIENCE [PROGRAMME DE L'EXPERIENCE 'ATLAS-BALLOON']

Apr. 1969 21 p In FRENCH
Avail: CFSTI

A description is given of a balloon-borne experiment, to be carried out in September 1969, to evaluate the ultraviolet magnitude of hot stars. The design, planning and operating conditions are described. ESRO

N69-35410# Landessternwarte auf dem Königsstuhl, Heidelberg (West Germany).

PLANNING AND PREPARATION OF EXTRATERRESTRIAL EXPERIMENTS FOR MEASUREMENT OF ZODIACAL LIGHT [PLANUNG UND VORBEREITUNG VON EXTRATERRESTRISCHEN EXPERIMENTEN ZUR MESSUNG DES ZODIAKALLICHTS]

C. Leinert May 1969 87 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. für Wiss. Forsch.
(BMwF-FB-W-69-13) Avail: CFSTI

In preparation of a zodiacal light experiment for the German solar probe model calculations have been carried out, considering the advantages of an interplanetary probe. For further preparation a rocket experiment is proposed to observe the zodiacal light round the sun on circles with radii between 15°–30°. Measurements on a prototype have shown that the required suppression of scattered light by a factor of about 10E13.8 is feasible. Author (ESRO)

N69-35435*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DETECTION OF INTERPLANETARY MAGNETIC FIELD FLUCTUATIONS STIMULATED BY THE LUNAR WAKE

N. F. Ness and K. H. Schatten Jul. 1969 39 p refs
(NASA-TM-X-63631; X-616-69-279) Avail: CFSTI CSCL 03B

The analysis of detailed measurements at 5.11 second intervals by the magnetic field experiment on Lunar Explorer 35 in the vicinity of the moon has revealed the presence of rapid fluctuations up to the instrument bandpass of 5 Hz with amplitudes of several gammas. These disturbances are transmitted both up and downstream from the penumbra into regions of space directly connected to the penumbra by the magnetic field. Power spectral analyses made in a field aligned coordinate system reveal that these fluctuations have approximately the same amplitude both parallel and transverse to the average field direction. Statistical studies are presented of the frequency of occurrence of the disturbances as a function of the distance to the point of observation from the lunar wake and of the fluctuation amplitude, and correlation with field magnitude. These observations suggest that the fluctuations have their source where the solar wind proton and electron distribution functions are disturbed by the removal of particles by absorption by the moon. Author

N69-35443*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

TRACKING AND DATA ACQUISITION FOR SPACE EXPLORATION

Robert J. Coates May 1969 75 p refs
(NASA-TM-X-63629; X-520-69-200) Avail: CFSTI CSCL 22C

The tracking and data acquisition systems provide the key link between the remote spacecraft and the scientific experimenter on the ground. The operation of the space experiment takes place through the links of command, telemetry and tracking and brought about the development of unified tracking and data acquisition systems which utilize hybrid pseudo-random code/sidetone ranging techniques. The data acquisition has evolved from analog telemetry systems to the present day heavy use of PCM digital telemetry. Likewise the command systems have evolved from early simple on/off command systems into PCM digital command data systems. The trend is toward greater real time control of more complex functions on board the spacecraft. Newer spacecraft are incorporating computer-type systems in the spacecraft which require programming and memory load through the ground command link. The most attractive concept for the next generation network for tracking and data acquisition is a network consisting of synchronous-orbit tracking and data relay satellites for covering launches and low-orbit earth satellites plus a few selected stations for supporting spacecraft in high earth orbit and lunar orbit. Author

N69-35467# Instituto Geografico y Catastral, Madrid (Spain). Servicio de Geomagnetismo y Aeronomia.

STUDY OF DEEP MAGNETIC ANOMALIES IN IBERIAN PENINSULA [ESTUDIO DE ANOMALIAS MAGNETICAS PROFUNDAS EN LA PENINSULA IBERICA]

Luis de Miguel 1969 17 p refs In SPANISH
Avail: CFSTI

The geomagnetic variations, with emphasis on the vertical component, are studied in several global areas. The areas include Japan, Germany, Italy, North America, and Spain which is of primary interest. An analysis of the magnetic anomalies for each of these areas is presented, and the distribution of the variation changes are graphed. Transl. by F.O.S.

N69-35468# Instituto Geografico y Catastral, Madrid (Spain). Servicio de Geomagnetismo y Aeronomia.

MAGNETIC ANOMALIES OF THE IBERIAN PENINSULA [ANOMALIAS MAGNETICAS DE LA PENINSUL IBERICA]

Jose Ruiz Lopez 1967 45 p ref In SPANISH
Avail: CFSTI

The magnetic anomalies of Spain are analyzed for updating of the reference epoch, and for geodetic mapping of magnetic variations. Equations for determining the difference in the magnetic fields of points considered along the isoanomalies and the geographic location of the center point for a nonmalmagnetic field are given. Geomagnetic maps of isoanomalies of Spain are included; tables and graphs summarizing the magnetic anomalies are presented. Transl. by F.O.S.

N69-35489*# Volt Information Sciences, Inc., Washington, D.C.
OPTIMUM LANDING OF A SPACECRAFT ON THE MOON
V. K. Issayev et al Greenbelt, Md. NASA Goddard Space Flight Center 20 Aug. 1969 10 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 7, no. 3, 1969 p 368–373
(Contract NAS5-12487)
(NASA-CR-104197; ST-GC-LS-10857-A) Avail: CFSTI CSCL 22C

The optimum landing of a spacecraft at a fixed point on the surface of the moon from a low circular AMS orbit is investigated. Analyzed are the influence of thrust load, of the height of the initial orbit and of the range of the landing site on the magnitude of spacecraft's final mass. Examples are brought out of optimum trajectories and optimum control programs of thrust magnitude and direction. Author

N69-35513*# Control Data Corp., Minneapolis, Minn.
METHOD OF DERIVING ORBITAL PERTURBING PARAMETERS FROM ONBOARD OPTICAL MEASUREMENTS OF AN EJECTED PROBE OR A NATURAL SATELLITE
C. B. Grosch and H. R. Paetznick Washington NASA Aug. 1969 98 p refs
(Contract NAS1-7540; Proj-9580)
(NASA-CR-1412) Avail: CFSTI CSCL 03A

An analytical investigation has been made to evaluate a method of determining perturbing forces by sightings taken from an orbiting spacecraft to a secondary satellite. The sightings, which are angular measurements between the satellite and certain stars, were assumed to be made intermittently over periods ranging from a fraction of one orbit to many days. In the investigation, the accuracy of determining the orbit of the spacecraft and of deriving the forces which perturb the orbit was studied. The study was conducted for spacecraft orbits about Mars, Venus, Moon, and Earth. The perturbing forces due to the gravitation potential of Mars, Venus, and the Moon were considered, as were the forces due to radiation pressure and drag for Earth. Author

N69-35605# European Space Research Inst., Frascati (Italy).
HYDROMAGNETIC WAVE INTERACTION WITH THE MAGNETOPAUSE AND THE BOW SHOCK
J. F. McKenzie 1969 49 p refs
Avail: CFSTI

The results of analyses of hydromagnetic reflection and refraction at a shear layer and at a shock are applied to situations representative of the magnetopause and the earth's bow shock. The almost complete absence of magnetic fluctuations in the outer fringes of the magnetopause is explicable in terms of the magnetopause behaving like a near perfect reflector to the turbulent hydromagnetic waves in the magnetosheath. Therefore it seems unlikely that the turbulent sound wave refraction mechanism is very effective in producing a viscous-like interaction between the solar wind and the magnetosphere. For conditions typical of the solar wind and the magnetotail during quiet times the stability analysis given here indicates that the tail of the magnetopause is unlikely to undergo Kelvin-Helmholtz instability. However, during times when the solar wind blows harder than it usually does the distant tail of the magnetopause will exhibit not only instability but also greatly enhanced hydromagnetic wave transmission into the tails from the magnetosheath. It is noted that both longitudinal and transverse waves can be amplified on passage through a strong shock. Thus the amplification of the turbulent spectrum of hydromagnetic waves in the solar wind on passage through the earth's bow shock may account for the (at least) order of magnitude increase of the noise spectrum in the magnetosheath over that in the unshocked solar wind. Author (ESRO)

N69-35645*# National Aeronautics and Space Administration, Washington, D.C.
AMERICA IN SPACE: THE FIRST DECADE. EXPLORING THE MOON AND PLANETS
William R. Corliss [1968] 29 p
(NASA-EP-52) Avail: SOD $0.50; CFSTI CSCL 22A

Results of Soviet and American space exploration programs to mid-year 1968 are summarized. E.C.

N69-35707# European Space Research Lab., Noordwijk (Netherlands).
DESCRIPTION OF EXPERIMENTS R-62 AND R-63, SARDINIA, JULY 1966: STELLAR UV PHOTOMETRY AND SPECTROPHOTOMETRY
D. E. Page Aug. 1966 9 p refs
(ESRO-SN-60(ESLAB)) Avail: CFSTI

The two experiments carried in this payload (S-05) are complementary. Experiment R-62 measures the total stellar flux in four wavelength bands between 1450 and 3200 Å. It is expected to observe about 60 early B-type stars during a 300-sec flight. Experiment R-63 examines spectra of individual stars, one particular star at a time, with a resolution of 120 Å; it covers the range 1450–3000 Å. Three attitude-measuring systems are included in the payload in order to establish which part of the sky has been examined. A full description is given of the two experimental sensors. Author (ESRO)

N69-35779# European Space Research Organization, Paris (France).
PREPARATIONS FOR ESRO'S FUTURE SCIENTIFIC PROGRAMME
In its ESRO/ELDO Bull. No. 5 May 1969 p 14–18(See N69-35776 20-34)
Avail: CFSTI

The article summarizes the reports of European scientists presented at a Symposium held in Paris, in May 1969 in order to prepare for the selection of the next major ESRO scientific projects on the basis of recent feasibility studies. The major items discussed were: an atmospheric research satellite; a dual spin satellite for polar ionospheric research; a scientific geostationary satellite; two cosmic ray satellites; two astronomical satellites and a Mercury probe. The final selection made by the Director General of ESRO on the basis of a more detailed examination by scientifically specialized groups, will comprise one or two projects selected from those described above and be submitted for decision to the Council of ESRO in July 1969. Further studies will prepare the next selection. ESRO

N69-35814# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON PINPOINTING MEASUREMENT DATA OF AUTOMATIC PROBES DESCENDING SMOOTHLY IN PLANETARY ATMOSPHERES TO A CENTER OF MASS
G. S. Golitsyn 1969 2 p ref Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 7, no. 3, 1969 p 462–463
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Formulas for verifying the mutual agreement between data on thermodynamic atmospheric parameters measured on automatic probes descending smoothly by parachute, such as achieved by the Soviet probe Venera 4, are analyzed. In addition to meeting the required accuracy, the first expression has an added advantage over previous methods in that the molecular weight is absent. After determination of the gravitational value in the form $g = kM/r^2$, the second and third formulas can be utilized for an independent calculation of the molecular weight. A.C.R.

N69-35819*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
SECULAR VARIATIONS OF ELEMENTS OF THE EARTH'S ORBIT WHICH INFLUENCE THE CLIMATES OF THE GEOLOGICAL PAST [O VEKOVYKH IZMENENIYAKH ELEMENTOV ORBITY ZEMLI, VLIYASHCHIKH NA KLIMATY GEOLOGICHESKOGO PROSHLOGO]
Sh. G. Sharaf et al Washington NASA Aug. 1969 39 p refs Transl. into ENGLISH from Byul. Inst. Teor. Astron. (USSR), v. 11, no. 4, 1967 p 231–261
(Contract NASw-1692)
(NASA-TT-F-12467) Avail: CFSTI CSCL 03A

Problems in connection with the determination of the secular perturbations of the earth's orbital elements affecting the climatological conditions in the far geological past, are studied. The expressions for the precessional values have been obtained in the trigonometric form. The calculations have been based on the Brouwer and van Woerkom theory of secular perturbations of elements of principal planets, corrected by the authors of the present paper. Diagrams are given illustrating changes in the perturbed values of the eccentricity of the Earth's orbit and the inclination of the ecliptic to the equator for the 3.10^7 years time interval backward from the epoch 1950. Author

N69-35824# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
CORRELATION BETWEEN ELECTRON PRECIPITATION AND MAGNETIC PULSATIONS [CORRELATION ENTRE LES PRECIPITATIONS ELECTRONIQUES ET LES PULSATIONS MAGNETIQUES]
J. P. Treilhou, J. Laffont, and F. Cambou May 1969 22 p refs In FRENCH
Avail: CFSTI

The origin and the mechanism of auroral events has been studied by correlation of balloon sounding and ground-based measurements. With a precise knowledge of the energy spectra of the X photons at the altitude of the balloon it is possible to draw the spectra of the primary electrons and to deduce their evolution as a function of the precipitation characteristics. ESRO

N69-35835# Centre National de la Recherche Scientifique, Marseilles (France). Laboratoire d'Astronomie Spatiale.
PROGRAM FOR EXPERIMENT NIGHT CAMERA-BALLOON [PROGRAMME DE L'EXPERIENCE 'CAMERA NOCTURNE-BALLON']
Jun. 1969 20 p ref In FRENCH
Avail: CFSTI

A description is given of a balloon-borne experiment to be carried out in spring 1969, to analyze the spectral distribution of the night sky emission in the 2000–3000 Å band. The camera unit will be comprised of hyperbolic mirror, grating and a Maksutoff-Bowen camera with a film sensitive to far ultraviolet radiation. ESRO

N69-35843*# Rensselaer Polytechnic Inst., Troy, N.Y.
TRAJECTORY CONTROL FOR MARS ENTRY BY DISCRETE CHANGES OF DRAG SURFACE AND FLIGHT PATH
Larry F. Hedge Aug. 1969 62 p refs
(Grant NGL-33-018-091)
(NASA-CR-105391; RPI-TR-MP-5) Avail: CFSTI CSCL 22C

The guidance problem in the entry phase of a Martian mission is complicated by the uncertainty which exists in the values of the atmospheric density parameters. For the controls in a guidance scheme, this investigation is concerned with using a discrete change in the ballistic coefficient by altering the effective area of drag, and a sequence of small discrete changes in the flight path angle by applying an impulsive force perpendicular to the direction of the velocity vector. To determine the effect of a change in the drag surface on the final values of the state variables, the area ratio was varied as a function of altitude. Simulating this procedure over the range of possible atmospheres determines the value of A/A_0 necessary to compensate for deviations from the reference set of atmospheric parameters. It will also determine the altitude at which the ballistic coefficient is changed as a function of the actual atmosphere. Author

N69-35876*# Techtran Corp., Glen Burnie, Md.
SYNTHESES OF OPTIMAL SYSTEM OF ORBITAL CONTROL OF A SYNCHRONOUS SATELLITE [SINTEZ OPTIMALBIOY SISTEMY UPRAVLENIYA ORBITOY STATSIONARNOGO ISKUSSTVENNOGO SPUTNIKA ZEMLI]
A. A. Lebedev et al Washington NASA Aug. 1969 16 p refs Transl. into ENGLISH from IFAC Tech. Session no. 49 (Warsaw), 18–21 Jun. 1969 p 115–130
(Contract NASw-1695)
(NASA-TT-F-12493) Avail: CFSTI CSCL 22C

In order to achieve the high precision required in the placement of a synchronous satellite, the wandering ellipse method must be used, with a control system based on feedback, considering all types of possible error. In this mathematical analysis of the method, the authors assume satellite movement in the equatorial plane, regard initial insertion error as a perturbation, and consider the phase coordinate vector of the satellite. Author

N69-35877*# Northrop Corp., Huntsville, Ala.
AS-506 "G" MANNED LUNAR LANDING MISSION POST-LAUNCH OPERATIONAL TRAJECTORY FOR 16 JULY 1969
J. Bradford, R. Maples, J. Reaves, R. Miller, J. Oliver, et al NASA. Marshall Space Flight Center Aug. 1969 128 p
(Contract NAS8-20082)
(NASA-CR-61291) Avail: CFSTI CSCL 22C

The AS-506 post launch trajectory contains the real-time operational trajectory using the actual Greenwich Mean Time of guidance reference release. Presented in this report are: (1) critical sequence of events, (2) AS-506 trajectory data, (3) translunar midcourse correction, (4) trajectory summary, (5) S-IC and S-2 spent stage trajectory data, and (6) S-4B slingshot trajectory data. Author

N69-35904# Royal Greenwich Observatory, Herstmonceux (England). H.M. Nautical Almanac Office.
THE PROBLEMS OF THE SATELLITES OF MARS
G. A. Wilkins Oct. 1968 16 p refs Presented at the Conf. on Celestial Mech., Rome, 12–15 Nov. 1968
(NAO-TN-16) Avail: CFSTI

Present knowledge of the properties of the Martian system is presented, and the theories of its evolution are critically reviewed. Landing a space probe on Phobos would permit the observation of relativistic effects. Author (ESRO)

N69-35959# Royal Greenwich Observatory, Herstmonceux (England). H.M. Nautical Almanac Office.
THE ANALYSIS OF THE OBSERVATIONS OF THE SATELLITES OF MARS
G. A. Wilkins Jul. 1967 15 p refs Submitted for publication
(NAO-TN-13) Avail: CFSTI

A general computerized procedure was developed for the analysis of positional observations of satellites (or other astronomical

bodies) and applied to the natural satellites of Mars to decide on secular variations. Furthermore, information could be derived on the planetary mass and shape and the gravitational field of Mars. Author (ESRO)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N69-34720# National Research Council of Canada, Ottawa (Ontario). Space Research Facilities Branch.

BLACK BRANT ROCKET AAF-4-17 LAUNCHED AT CHURCHILL RESEARCH RANGE, 19 JANUARY 1969

Jun. 1969 25 p refs *Its* Operations Requirement No. 354 (SRFB-023) Avail: CFSTI

The engineering aspects of preparing the payload and the launching of Black Brant rocket AAF-4-17 on 13 January 1969 are reported. The payload was designed to measure properties of elementary particles in the upper atmosphere employing six different experimental apparatuses during a period of enhanced aurora. Because of the lack of second stage ignition, the peak altitude attained was only 321,600 feet rendering experimental results marginal. Author

N69-34748*# Martin Co., Denver, Colo.

TERMINAL DESCENT SIMULATION STUDY Final Report

Richard F. Broderick, Michael K. Mann, Richard D. Moog, Billie W. Preston, Parker S. Stafford et al Jul. 1969 267 p refs (Contract NAS1-8913) (NASA-CR-66811) Avail: CFSTI CSCL 22B

A Martian soft lander terminal descent simulation program has been developed. The program is designed to simulate the parachute and terminal descent phases of the Mars Lander (soft landing) mission, but with slight modifications it can also be used for simulating other phases. Instructions for using the program are provided in a separate user's guide. Concurrent studies were conducted with the simulation program on several landing radar mechanizations to evaluate their performance characteristics in connection with the soft lander mission. These studies were made with the help of the terminal descent program and static and time-correlated Monte Carlo simulations. Author

N69-34901*# Texas Univ., Austin. Engineering Mechanics Research Lab.

SUBOPTIMAL COMPENSATION OF GYROSCOPIC COUPLING FOR INERTIA-WHEEL ATTITUDE CONTROL

W. L. Garrard and L. G. Clark (Minn. Univ., Minneapolis) Nov. 1967 38 p refs (Contract NAS8-18120) (NASA-CR-61825; EMRL-RM-1041) Avail: CFSTI CSCL 22A

Two procedures are developed for the synthesis of inertia-wheel systems for three dimensional attitude control. Both techniques compensate for inter-axis coupling due to the angular momentum of the inertia wheels. In addition, both procedures approximately minimize the integral of a quadratic function of system error and control effort and are suboptimal in a mathematical sense. The techniques developed in this paper are applied to the design of an attitude control system for a large axially symmetric spacecraft similar to the proposed Orbiting Astronomical Observatory. In a computer simulation, the suboptimal systems were shown to respond faster and more accurately than those designed by conventional transform techniques or by optimization procedures based on time-invariant approximations of the equations of motion. Author

N69-34902*# Texas Univ., Austin. Engineering Mechanics Research Lab.

ON THE SYNTHESIS OF SUBOPTIMAL, INERTIA-WHEEL ATTITUDE CONTROL SYSTEMS

W. L. Garrard (Minn. Univ., Minneapolis) and L. G. Clark Oct. 1968 24 p refs (Contract NAS8-18120; Grant NSF GK-3273) (NASA-CR-61798; EMRL-1065) Avail: CFSTI CSCL 22A

Two techniques are presented for the synthesis of suboptimal systems using motor-driven inertia wheels as the source of torque for three dimensional attitude control. These techniques approximately minimize the integral of a quadratic function of system error and control effort, and both procedures compensate for nonlinear inter-axis coupling. The techniques developed in this paper are applied to the design of an attitude control system for a typical artificial satellite. The resulting control laws are in feedback form. In a computer simulation, systems designed on the basis of the procedures developed are shown to respond faster and more accurately than those designed by optimization procedures based on linearized approximations of the equations of motion. Author

N69-34968# National Research Council of Canada, Ottawa (Ontario).

BLACK BRANT ROCKET AAF-11-125 LAUNCHED AT CHURCHILL RESEARCH RANGE, 13 DECEMBER 1968

Mar. 1969 32 p refs (SRFB-021) Avail: CFSTI

The engineering aspects of preparing the payload and launching Black Brant Rocket AAF-2-125 at Churchill Research Range in December 1968 are reported. This vehicle was launched into the peak of the Geminid micrometeorite shower at 0345 central standard time 13 December 1968. A recoverable payload containing various types of micrometeoroid detectors, micrometeoroid collectors and plasma probes was carried. A power cut to the experiments, prematurely initiated by the master sequencer at T + 73.6 seconds, resulted in the acquisition of very little data and in the failure of payload separation and recovery. Author

N69-34980*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

TRACKING AND DATA SYSTEM SUPPORT FOR SURVEYOR MISSIONS I AND II, VOLUME 1

N. A. Renzetti 15 Jul. 1969 315 p refs (Contract NAS7-100) (NASA-CR-104120; JPL-TM-33-301-Vol-1) Avail: CFSTI CSCL 22B

This report covers the tracking and data system (T&DS) activities for Surveyors 1 and 2, from the time the requirements on the system were established by the Project objectives and the spacecraft design, through the preparation of the network-support plans, the implementation of the necessary facility configurations, the performance of the requisite tests to establish operational readiness, the support of the actual flights to the end of each mission – with a comprehensive account of the tracking operations, and an evaluation of that support. To better define the requirements on the T&DS, the *Surveyor* Mission objectives are reviewed and descriptions of the *Atlas/Centaur* launch vehicle and of the spacecraft are included, as are synopses of the first two *Surveyor* flights. Associated equipment and activities of the three elements of the Deep Space Network, i.e., the Deep Space Instrumentation

Facility, the Ground Communications Facility, and the Space Flight Operations Facility, in meeting the metric, telemetry, command, and tracking demands of the missions are documented. Technical and statistical data concerning launch, trajectory, operating modes, tracking time, received-signal levels, command lockups, data transmission and reduction are presented. Author

N69-34977# Technische Univ., Berlin (West Germany).
SYSTEMS ANALYSIS OF A CLASS OF HEAVY SPACE PROBES FOR UNMANNED RESEARCH IN THE SOLAR SYSTEM [SYSTEMUNTERSUCHUNG EINER KLASSE SCHWERER RAUMSONDEN ZUR UNBEMANNTEN ERFORSCHUNG DES SONNENSYSTEMS]
Horst F. Thomae (Ph.D. Thesis) 1969 243 p refs In GERMAN
Avail: CFSTI

The use of heavy space probes, launched by powerful vehicles of the Saturn 5 type, for research in the solar system is analyzed. Based on the concept of the universal use of such probes for a great variety of tasks, this study defines mission possibilities, estimates the success of specific missions, proposes a flight program for the period from 1970 to 1985, and optimizes these missions using derived flight criteria. The assumptions and numerical values used in these planetary subprograms are analyzed for their sensitivity in order to establish model stability. Detailed data are presented for flight mechanics and subsystem calculations. Technological requirements for the development of the probes are outlined. Transl. by K.W.

N69-34989*# Avco Corp., Wilmington, Mass. Government Products Group.
ISOTOPE REENTRY VEHICLE DESIGN STUDY PRELIMINARY DESIGN; PHASE 2 Final Report
Richard L. Ryan and John W. Graham Aug. 1969 466 p refs
(Contract NAS3-10938)
(NASA-CR-72555; AVSD-0306-69-RR) Avail: CFSTI CSCL 22B

Preliminary design efforts to develop a 25 kW_t (end-of-life) Pu 238 heat source Isotope Reentry Vehicle (IRV) are summarized. The emphasis was placed on feasibility and safety considerations. Heat source and heat source exchanger concept combinations were developed, and three of the more promising combinations were evaluated at the conceptual design level. The analytical evaluation included systems analysis, reentry performance, and heat source design as well as IRV heat shield, aeroshell structure, and thermal control. Design, performance, insulation, and structural details of the heat source heat exchanger were considered. The integration of the IRV system with the Brayton cycle power system, overall integration with the spacecraft, and ground handling requirements were also analyzed. K.W.

N69-35000# Stanford Univ., Calif. School of Engineering.
DEMETER: AN EARTH RESOURCES SATELLITE SYSTEM Final Report
Jun. 1968 526 p refs
(PB-183089) Avail: CFSTI CSCL 05C

The Demeter satellite system would observe the earth in the optical, near infrared, and thermal infrared wavelengths and produce real time multiband pictures approximately every two weeks for distribution to the various users. Studies presented in this report indicate annual benefits on the order of billions of dollars which make the six satellite, four year cost of 103 million dollars well justified. The study also presents the economic and political as well as technical point of view. The technical studies are based on an operational date of 1973 and anticipate modest advancement of the state-of-the-art. They pursue the design of new systems through most of the theoretical problems to a point where production seems feasible. Author (USGRDR)

N69-35087# Naval Research Lab., Washington, D.C.
CONTINUOUSLY VISIBLE SATELLITE CONSTELLATIONS Final Report
R. L. Easton and R. Brescia Apr. 1969 11 p
(AD-688415; NRL-6896) Avail: CFSTI CSCL 17/9

For many purposes (e.g., communication and navigation) it is necessary to have one or more satellites visible at all times. It is therefore important to know the minimum number of satellites required to meet the specific need. Author (TAB)

N69-35182# British Aircraft Corp. (Operating) Ltd., Bristol (England). Space and Instrumentation Group.
BRITISH PARTICIPATION IN INTELSAT IV
D. O. Fraser and C. Rowe May 1969 20 p Presented at the 9th Brit. Interplanet. Soc. European Space Symp., London, 14–16 May 1969
(SIG-59) Avail: CFSTI

The participation of the British industry in designing and manufacturing the Intelsat IV is explained. ESRO

N69-35240# European Space Research and Technology Center, Noordwijk (Netherlands).
THE ACCELERATION ENVIRONMENT OF A SPACECRAFT AND ITS SIMULATION IN THE LABORATORY. SHOCK AND VIBRATION: PART 1 [L'ENVIRONNEMENT 'ACCELERATION' D'UN ENGIN SPATIAL ET SA SIMULATION EN LABORATOIRE. PREMIERE PARTIE: CHOCS ET VIBRATIONS]
G. Bertaud Jan. 1969 36 p refs In FRENCH; ENGLISH summary Presented at the 6th ESRO Summer School, Noordwijk, Neth., 1968
(ESRO-TM-105) Avail: CFSTI

This paper is confined to a general outline of the shock and vibration liable to disturb a spacecraft until it is placed in orbit. The first chapter deals with the environment encountered in transportation, an environment sometimes wrongly dismissed as being of only secondary importance. The second chapter deals with the environment encountered at the time of launching. Since the spacecraft is no longer protected by its transport container the launch phase is considered to be the most dangerous. ESRO

N69-35262*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
STUDY FOR PASSIVE GRAVITY STABILIZATION Final Technical Report, Jul. 1967–Mar. 1968
30 Aug. 1968 318 p
(Contract NAS8-21177)
(NASA-CR-98036; DOC-68SD4310) Avail: CFSTI CSCL 22B

A design feasibility study to define attitude stabilization configurations, component designs, and a flight experiment program which will demonstrate the techniques of passive gravity stabilization for large spacecraft, such as the S-4 stage of the Saturn launch vehicle, and the lunar module of the Apollo spacecraft, is reported. The study includes selection of configurations for five in-flight stabilization experiments and the definition of a flight experiment to evaluate the characteristics of the large deployable rod used to position tip weights in gravity gradient stabilization systems. Experiment profiles are shown for four flight experiments, along with operational plans and mission requirements. A program plan is included showing tasks required to design and develop new

components, integrate the flight experiment components into the spacecraft complete the flight experiment and analyze results. Author

N69-35402# Junkers Flugzeug- und Motorenwerke A. G., Munich (West Germany).
THE DEVELOPMENT OF THE HEOS-1 SATELLITE: AN ESRO SATELLITE PROGRAM
14 May 1969 34 p Presented at the 9th Brit. Interplanet. Soc. European Space Symp., London, 14–16 May 1969
Avail: CFSTI

An account is given of the development work on the ESRO Highly Eccentric Orbit Satellite (HEOS) which was carried out by a European consortium. Details are given of the cost, performance, orbit characteristics, weight, power requirements and the scientific experiments of this satellite launched on 5 December 1968. ESRO

N69-35482*# Techtran Corp., Glen Burnie, Md.
TURN MANEUVER CONTROL OF A CIRCULAR ORBIT PLANE INSURING PASSAGE OF A SATELLITE THROUGH A GIVEN POINT [PRAVLENIE MANEVROM POVOROTA PLOSKOSTA KRUGOVOY ORBITY SPUTNIKA, OBESPECHIVAYUSCHEE PROKHOZHDENIE SPUTNIKA CHEREZ ZADANNYYU TOCHKU]
Yu. P. Guskov and S. V. Bunyakin Washington NASA Aug. 1969 14 p refs Transl. into ENGLISH from IFAC Tech. Session no. 57 (Warsaw), 16-21 Jun. 1969 p 84–97
(Contract NASw-1695)
(NASA-TT-F-12497) Avail: CFSTI CSCL 22C

A method for formulating the maneuver of rotation of the plane of a circular orbit of a satellite, insuring its passage through a given point, either fixed or related to the earth, is examined in this report. It is assumed that the satellite is equipped with a constant thrust engine, gyrostabilized platform, angular stabilization system, accelerometers, and a computer. In the case of a non-throttleable engine, the problem of control reduces to the determination and realization of the moments of ignition and shutdown of the engine and the corresponding attitude of the thrust vector. Author

N69-35490*# Volt Information Sciences, Inc., Washington, D.C.
OPTIMUM SPACECRAFT LIFT-OFF FROM THE MOON'S SURFACE
V. K. Isayev et al Greenbelt, Md. NASA. Goddard Space Flight Center 20 Aug. 1969 7 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 7, no. 3, 1969 p 374–376
(Contract NAS5-12487)
(NASA-CR-104198; ST-CM-LS-10858) Avail: CFSTI CSCL 22A

The problem of optimum landing of a spacecraft from the AMS orbit on the moon's surface is investigated. Presented here are the results of the analysis of the problem's numerical solution and, in particular, the material for comparison of optimum programs with theoretical dependences. The present work is dedicated to the investigation of motion dynamics over the subsequent stage of lunar expedition which is the spacecraft's lift-off from lunar surface into the circular AMS orbit. These two maneuvers have much in common from the standpoint of the application of optimization methods Author

N69-35493# British Aircraft Corp., Filton (England). Guided Weapons Div.
UK4 SATELLITE Status Report
J. L. Crowder May 1969 3 p refs Presented at the 9th Brit. Interplanet. Soc. European Space Symp., London, 14–16 May 1968
Avail: CFSTI

Fundamental planning of UK4 satellite, using residual UK3 hardware, for launching in 1971 is described. ESRO

N69-35504*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ADVANCED LUNAR STUDIES: STUDY OF SURVEYOR EXTENDED MISSION
1 Nov. 1967 41 p refs
(Contract NAS7-100)
(NASA-CR-104200; JPL-760-11) Copyright. Avail: CFSTI CSCL 22A

Some of the most important experiments in a rational lunar exploration program require placement of long lived instruments in remote regions on the moon. The object of this report is to set forth the engineering requirements for executing such missions using Surveyor spacecraft. The engineering requirements discussed are those uniquely associated with this extended mission. Surveyor ground and flight experience to date has revealed a need for other engineering changes which should be made as a part of any Surveyor follow-on; some of these changes are mentioned where pertinent, but the report is not intended to provide a complete discussion of them. For clarity, these two classes of changes are referred to below as mission-dependent and mission-independent, respectively. For the purpose of this study, it is assumed that the long lived Surveyors would be operating as part of a coordinated program including other lunar missions such as mobile experiments and manned landings, and so would have to share the use of ground-based tracking, data acquisition, and data reduction facilities. Author

N69-35507*# Techtran Corp., Glen Burnie, Md.
DYNAMIC INVESTIGATIONS OF A PRELIMINARY STABILIZATION SYSTEM OF A GRAVITY-STABILIZED SATELLITE TAKING INTO ACCOUNT TRANSDUCER CONSTRAINTS AND STABILIZER BENDING OSCILLATIONS [ISSLEDOVANIE DINAMIKI SISTEMY PREDVARITELNOGO USPOKOENIYA GRAVITATSIONNO-USTOYCHIVOGO SPUTNIKA S UCHETOM ORGANICHENIY DATCHIKOV I IZGIBNYKH KOLEBANIY STABILIZATORA]
V. I. Popov and V. Yu. Rutkovskiy Washington NASA Aug. 1969 18 p refs Transl. into ENGLISH from IFAC Tech. Session no. 57 (Warsaw), 16-21 Jun., 1969 p 35–52
(Contract NASw-1695)
(NASA-TT-F-12496) Avail: CFSTI CSCL 22B

The dynamics of a relay gas reaction preliminary stabilization system (PSS) on the phase plane with consideration of transducer limitations is examined. The question concerning the use of constrained transducers for the formulation of the nonlinear laws of control is also discussed. Internal feedback to compensate for lag is proposed for the purpose of reducing the amplitude of auto-oscillations in a PSS with relay characteristics and a hysteresis loop. The rotational motions of a satellite with arms extended are analyzed. The equations of the flat bending oscillations of the satellite stabilizer system are derived, and the effect of natural and artificial damping in the arms and the bending oscillations of the system while the PSS is in operation are discussed. Author

N69-35530*# Techtran Corp., Glen Burnie, Md.
DYNAMICS OF TRANSFER OF ASTRONAUTS TO A SPACECRAFT BY MEANS OF A ROPE AND THE PRINCIPLES OF SYNTHESIS OF SPACECRAFT CONTROL BASED ON

THE THEORY OF VARIABLE STRUCTURE SYSTEMS [DINAMIKA PEREMESHCHENIYA KOSMONAVTA K KORABLYU S POMOSHCHYU TROSA I PRINTSIP SINTEZA UPRAVLENIYA KORABLEM, OSNOVANNYI NA TEONII SISTEM S PEREMENNOY STRUKTUROY]

V. N. Soshnikov and G. M. Ulanov Washington NASA Aug. 1969 17 p refs Transl. into ENGLISH from IFAC Tech. Session no. 49 (Warsaw), 16–21 Jun. 1969 p 16–30
(Contract NASw-1695)
(NASA-TT-F-12486) Avail: CFSTI CSCL 22A

The determination of the range of initial conditions under which the retrieval process can be accomplished with given limitations is considered. The solution of this problem will permit the determination of the practical suitability of an uncontrolled tether system. The method most suitable in this case for synthesizing the angular control of the spacecraft, which would make it possible to eliminate those properties of the tether retrieval system which complicate its practical use, is determined. These problems are solved in the case of planar motion of the system at a constant rate of twisting of the tether. Author

N69-35531*# Techtran Corp., Glen Burnie, Md.
STOCHASTIC OPTIMIZATION OF CONTROL OF DESCENT OF A SPACECRAFT IN THE ATMOSPHERE [STOKHASTICHESKAYA OPTIMIZATSIYA UPRAVLENIYA SPUSKOM KOSMICHESKOGO APPARATA V ATMOSFERE]

A. G. Vlasov, E. I. Mitroshin, and I. S. Ukolov Washington NASA Aug. 1969 13 p refs Transl. into ENGLISH from IFAC Tech. Session no. 49 (Warsaw), 16–21 Jun. 1969 p 52–66
(Contract NASw-1695)
(NASA-TT-F-12489) Avail: CFSTI CSCL 22C

The problem of descent of a spacecraft in the earth's atmosphere in the case of reentry into the atmosphere at velocities exceeding the initial space velocity is analyzed in this report. The optimal control system for descent such that the spacecfaft is certain to land at a predetermined point, in observance of restrictions on loads, aerodynamic heating, and other factors, is synthesized. The problem of the control of descent of the spacecraft is analyzed in the stochastic statement, which reduces to the problem of optimal control of the terminal state of a stochastic dynamic system. Author

N69-35535*# TRW Systems Group, Redondo Beach, Calif.
SCOUT ERROR ANALYSIS Final Report
Lester B. Cohen 19 Sep. 1968 114 p ref
(Contract NAS1-6969)
(NASA-CR-66674) Avail: CFSTI CSCL 22D

The effects of Scout error sources were analyzed both individually and collectively during the following two missions: (1) a four-stage trajectory designed to reenter the Earth's atmosphere and the expected dispersions in the trajectory at an altitude of 400,000 feet; and (2) a five-stage mission with the fifth stage spin-stabilized, designed to enter interplanetary space. The error source magnitudes and the method of analysis are briefly described. The calculated data for mean, variances, extreme values, and three sigma contributions of each error source to altitude dispersion, velocity, flight path angle, and inclination are presented in tables and graphs. K.W.

N69-35539*# TRW Systems Group, Redondo Beach, Calif.
PROPULSION BEAM DIVERGENCE EFFECTS Quarterly Technical Report
15 May 1969 40 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952350)
(NASA-CR-105316; QTR-1) Avail: CFSTI CSCL 22B

The second phase of a program to develop understanding of and tolerance-level criteria for the deleterious effects of electrostatic rocket exhaust (Cs, Cs^+, Hg, Hg^+) impinging on typical classes of spacecraft surfaces is underway. This phase includes fabrication of necessary experimental fixtures and exploratory experiments. The current status of fixture design, fabrication, and testing is reported along with early results of exposures of Kapton to Cs and soft solder to Hg. Author

N69-35549*# Techtran Corp., Glen Burnie, Md.
THEORY OF BIROTOR GYRO-ORBIT [TEORIYA DVUKHROTORNOY GIROORBITY]

V. A. Besekerskiy, V. G. Gordeyev, and Ya. G. Ostromukhov Washington NASA Aug. 1969 13 p refs Transl. into ENGLISH from IFAC Tech. Session no. 57 (Warsaw), 16–21 June 1969 p 3–14
(Contract NASw-1695)
(NASA-TT-F-12494) Avail: CFSTI CSCL 22B

The basic dynamic properties of a birotor gyroorbit, which in contrast to a monorotor gyroorbit, operates under more favorable conditions and contains no errors related to the requirement to organize the precessional motion of the gyrovertical, thus greatly improving the precision in the memory mode, are analyzed. The device is distinguished by the fact that it incorporates two gyroscopes with kinetic moments arranged in the orbital plane at 90° to each other. The birotor gyroorbit has a modulating effect with respect to constant drifts of the gyroscopes, and it improves the precision of plotting of the reference coordinate system aboard an artificial earth satellite by levelling off the interferences contained in the signal of the plotter of the local vertical. Author

N69-35568*# Techtran Corp., Glen Burnie, Md.
INVESTIGATIONS OF MULTIPLEX AUTO-OSCILLATIONS OF SPACECRAFT [ISSLEDOVANIYE SLOZHNYKH AVTOKOLEBANIY KOSMICHESKIKH APPARATOV]

E. V. Gaushus Washington NASA Aug. 1969 18 p refs Transl. into ENGLISH from proc. of the 4th Congr. of the Intern. Federation of Autom. Control, IFAC Tech. Session no. 57, 1969 p 15–34 Presented at Conf. on Guidance and Control in Space, Warsaw, 16-21 Jun. 1969
(Contract NASw-1695)
(NASA-TT-F-12495) Avail: CFSTI CSCL 22B

Point reflection method is used to investigate the dynamics of spacecraft. Flat oscillations of a spacecraft near the center of mass are analyzed. The construction of point transformation, determination of periodic motions, stability of complex periodic motions and certain other types of periodic motions are described analytically. Author

N69-35608# European Space Research Organization, Paris (France).
REPORT PRESENTED TO THE TWELFTH COSPAR MEETING
1 Apr. 1969 90 p Conf. held at Prague, May 1969
Avail: CFSTI

This ESRO report to COSPAR, 1969, gives preliminary results obtained with the ESRO 1, ESRO 2 and HEOS A1 satellites and discusses plans for the future HEOS A2 and TD-1 satellites. Results obtained with sounding rockets launched at Kiruna, Sweden, and Salto di Quirra, Sardinia are also presented. ESRO

N69-35617# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES, JANUARY 1969

R. D. Eberst 31 Mar. 1969 20 p
(ROE-STS-85) Avail: CFSTI

Tables of satellite stopwatch observations from various stations, giving right ascension, declination, angular accuracy, epoch of position coordinates, stellar magnitude, and flash period are presented. ESRO

N69-35653*# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
SPACEBORNE MEMORY ORGANIZATION: APPENDICES Interim Report
[1969] 126 p refs
(Contract NAS12-38)
(NASA-CR-86204; Rept-12017/RI) Avail: CFSTI CSCL 22B

The requirements for an unmanned spacecraft involved in planetary exploration during the period from 1975 to 1985 are discussed. Only those functions or tasks that have extensive computational requirements are examined. This covers the following five areas: (1) data handling, including acquisition, storage, retrieval, and distribution of both scientific and performance data; (2) processing of scientific data, including data compression, on-board decision making, and side looking radar requirements; (3)navigation of spacecraft, with reference trajectory and state transition matrix computational techniques and state estimation computations; (4) requirements for navigation and control of lander; and (5) command and communications processing. An extensive survey of information storage devices suitable for associative memories was conducted. This survey includes such active elements as integrated circuits, cryotrons, and discrete tunnel diodes; a large number of hysteresis elements; read-only elements; and cyclic-access media. K.W.

N69-35657*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
A STUDY OF APPLICATION OF REMOTE MANIPULATION TO SATELLITE MAINTENANCE Final Report, Volume 1: Summary Report
Jun. 1969 40 p refs
(Contract NAS2-5072)
(NASA-CR-73338; NASA-R-73-338-Vol 1; DOC-69SD4288-Vol-1) Avail: CFSTI CSCL 22B

Feasibility of design, development, operation, and costs was studied for a remote manipulator spacecraft to be used for in-orbit repair and maintenance of a satellite. The concept was applied in the study of four satellite systems representing a cross section of satellite designs and characteristics. Standard satellite design practices were identified which could simplify in-orbit maintenance. The design constraints were minimum cost, simplicity, ground control link only, and use of the spacecraft for one mission only. Portions of the maintenance missions were simulated in a setup that included M-8 mechanical bilateral manipulators and a remote television display. Such characteristics as manipulator force, torque, reach requirements, mission duration, weight of the package containing the maintenance parts, thrust requirements, special tools, and docking equipment were determined. Development, recurring, and sustaining portions of the costs were specified for spacecraft operation, ground station, and factory test equipment. The study shows that a remote manipulator spacecraft system is feasible with only minimum modifications of existing hardware or designs. K.W.

N69-35658*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
A STUDY OF APPLICATION OF REMOTE MANIPULATION TO SATELLITE MAINTENANCE Final Report, Volume 2: Technical Report
Jun. 1969 415 p refs
(Contract NAS2-5072)
(NASA-CR-73339; NASA-R-73-339-Vol-2; DOC-69SD4288-Vol-2) Avail: CFSTI CSCL 22B

This volume contains the detailed data, illustrations, and descriptions of the remote manipulator spacecraft feasibility study. In addition to details concerning mission analyses, laboratory simulations, and design recommendations as specified in abstract N69-35657, this volume presents information on manipulator tools, reliability and failure modes, design of subsystems, rendezvous requirements, time delay, and development schedules. K.W.

N69-35659*# Techtran Corp., Glen Burnie, Md.
OPTIMAL PARAMETRIC PRINCIPLES OF THE CONTROL OF THE DESCENT OF SPACECRAFT [OPTIMIMALBYNE PARAMETRICHESKIY ZAKONY UPRAVLENIYA SNIZHENIEM KOSMICHESKOGO APPARATA]
V. M. Ponomariyev et al Washington NASA Aug. 1969 14 p refs Transl. into ENGLISH from IFAC Tech. Session no. 49 (Warsaw), 16–21 Jun. 1969 p 39–51
(Contract NASw-1605)
(NASA-TT-F-12488) Avail: CFSTI CSCL 22C

The presence aboard the spacecraft of a navigational block and computer by which it is possible to determine continuously the parameters of motion and to formulate the controlling signals by rather complex algorithms makes it possible to use parametric programs of control when the programmed trajectory is a function of some kinematic or dynamic parameter of the trajectory. Physically, the programming of the nominal trajectory as the function of the parameters equivalent to the presence of feed-back in the contour of programmed motion, makes it possible to consider indirectly the random perturbations acting on the spacecraft. Author

N69-35718*# Rensselaer Polytechnic Inst., Troy, N.Y. School of Engineering.
ANALYSIS AND DESIGN OF A CAPSULE LANDING SYSTEM AND SURFACE VEHICLE CONTROL SYSTEM FOR MARS EXPLORATION Progress Report, 1 Jul. 1968–30 Jun. 1969
D. K. Frederick, P. K. Lashmet, G. N. Sandor, C. N. Shen, E. J. Smith et al 15 Jul. 1969 71 p refs
(Grant NGL-33-018-091)
(NASA-CR-105395; MP-4) Avail: CFSTI CSCL 22B

Investigation of problems related to the landing and controlling of a mobile planetary vehicle according to a systematic plan of exploration of Mars was undertaken. Problem areas receiving consideration include:updating of atmosphere parameters during entry, adaptive trajectory control, unpowered aerodynamic landing, terrain modeling and obstacle sensing, vehicle dynamics and attitude control, and chromatographic systems design concepts. The specific tasks undertaken are defined, and the progress made during the interval July 1, 1968 to June 30, 1969 is summarized. Projections for work to be undertaken during the next six months period are included. Author

N69-35763*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SURVEYOR PROJECT. PART 1: PROJECT DESCRIPTION AND PERFORMANCE. VOLUME 2 Final Report
1 Jul. 1969 590 p refs
(Contract NAS7-100)
(NASA-CR-105302; JPL-TR-32-1265) Copyright. Avail: CFSTI CSCL 22B

The Surveyor spacecraft designs are described for the overall objectives of transit from earth to the moon, performing a soft landing, and transmitting scientific and engineering data relative to

the environment and characteristics of the moon. The topics include: (1) spacecraft systems, (2) spacecraft structures and mechanisms, (3) thermal control, (4) spacecraft power, (5) spacecraft propulsion, (6) flight control subsystem, (7) spacecraft radar, (8) spacecraft radio, (9) spacecraft signal processing and command, (10) spacecraft scientific instrument payload, and (11) summary of recommendations. F.O.S.

N69-35777# European Space Research Organization, Paris (France).
ESRO'S CURRENT AND FUTURE SATELLITE PROGRAMME
In its ESRO/ELDO Bull. No. 5 May 1969 p 4–9 (See N69-35776 20-34)
Avail: CFSTI

Discusses current ESRO satellite programmes i.e. TD-1 project (launch scheduled for spring 1962), HEOS A-2, and the TD-2 'rescue operation' for allocation of the main experimental programmes planned for the abolished project to other missions. Summarizes the TD-1 project salient characteristics and describes the seven experiments on board. Four of these will scan the sky in various regions of the electromagnetic spectrum in order to study the emission from the stars. A fifth experiment will measure the charge spectrum of primary particles with a cosmic ray telescope mounted along the main axis of the satellite. The other two experiments will measure the high energy solar emission and are aligned along the sun pointing axis. The main features of the HEOS A-2 mission are the study of cosmic ray propagation in the solar system in correlation with direct measurement of interplanetary fields and particles and the properties of the boundary between the magnetosphere and interplanetary space. Further satellite programmes are also outlined. ESRO

N69-35781# European Space Vehicle Launcher Development Organization, Paris (France).
TECHNICAL PROGRAMME [PROGRAMME TECHNIQUE]
In its ESRO/ELDO Bull. No. 5 May 1969 p 31–33 In ENGLISH and FRENCH (See N69-35776 20-34)
Avail: CFSTI

The technical programme is outlined for the next flight test (F8) of the Europa launch vehicle scheduled for the end of June 1969 along with the major improvements and modifications subsequent to the last firing. ESRO

N69-35782# European Space Research Organization, Paris (France).
PROGRESS IN OPERATIONAL PROGRAMME [ETAT D'AVANCEMENT DU PROGRAMME OPERATIONNEL]
In its ESRO/ELDO Bull. No. 5 May 1969 p 34–40 In ENGLISH and FRENCH (See N69-35776 20-34)
Avail: CFSTI

Progress in ESRO operational programmes mainly concern IRIS 9esro 2), Aurorae (ESRO 1) and HEOS 1 satellites performances in orbit. The progress in the TD-1 satellite project, already in an advanced development phase is also mentioned. A complete record of sounding rocket launchings and experiments is given. ESRO

N69-35801*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SATURN 5 FLIGHT MANUAL, SA-506
25 Feb. 1969 224 p refs
(NASA-TM-X-61801; MSFC-MAN-506) Avail: CFSTI CSCL 22B

A single-source reference on the characteristics and functions of the SA-506 launch vehicle and the AS-506 flight mission is presented for use by astronauts. Included are: (1) general mission and performance data; (2) emergency detection system information; (3) descriptions of each stage and the IU; and (4) a general discussion of ground support facilities, equipment, and mission control. A.C.R.

N69-35839*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RESEARCH AND ADVANCED DEVELOPMENT, VOLUME 1: OSSA Semiannual Review, 1 Jan. – 30 Jun. 1969
15 Aug. 1969 387 p refs
(Contract NAS7-100)
(NASA-CR-105386; JPL-701-32-Vol-1) Copyright. Avail: CFSTI CSCL 22A

All supporting research and technology in progress at the Jet Propulsion Laboratory during the period January 1 to June 30, 1969 under the direction of the JPL Office of Research and Advanced Development, for the NASA Office of Space Sciences and Applications are reviewed. The work units are arranged in numerical sequence by NASA code in each subject section. The research and advanced development results published during this report period are listed under each work unit. Author

N69-35854*# Techtran Corp., Glen Burnie, Md.
CERTAIN QUESTIONS ON THE SYNTHESIS OF CONTROL SYSTEMS FOR THE SPATIAL MOTION OF ORBITAL SPACECRAFT IN THE EARTH'S ATMOSPHERE [NEKOTORYYE VOPROSY SINTEZA STRUKTUR SISTEM UPRAVLENIYA PROSTRANSTVENNYM DVIZHENIYEM ORBITAL'NOGO SAMOLETA V ATMOSFERE ZEMLI]
B. N. Petrov et al Washington NASA Aug. 1969 18 p refs Transl. into ENGLISH from IFAC Tech. Session no. 49 (Warsaw), 16–21 Jun. 1969 p 3–18
(Contract NASw-1695)
(NASA-TT-F-12487) Avail: CFSTI CSCL 22C

Linear multichannal systems in which the connection of the channels is governed by the aircraft itself, are examined in this work and the problem of finding the set G|M,S,L| of structures that insure selective invariance is analyzed so that in the future it will be possible to select the best of them, both in the sense of quality and in the sense of simplicity of realization. Author

N69-35889*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY NO. 37-57, VOLUME 1: 1 MARCH – 30 APRIL 1969, FLIGHT PROJECTS
31 May 1969 71 p refs
(Contract NAS7-100)
(NASA-CR-105309; JPL-SPS-37-57-Vol-1) Copyright. Avail: CFSTI CSCL 22B

Details are given on the project descriptions, status, systems engineering, and telecommunications for the Mariner Mars 1969, Mariner Mars 1971, and Viking projects. Emphasis is given to Mariners 6 and 7, and their preflight planning, launching, thermal insulation, and initial performance of the communication and the guidance and control subsystems. The modifications of the Mariner Mars 1969 vehicles for the 1971 vehicles are described for the missions to map the topography and to obtain data on time-variable features and planetary properties. The research and development of a high impact traveling wave tube are discussed for the Viking 1973 project, and the mass spectra model and guidance and control subsystem are mentioned. N.E.N.

N69-35890*# BAI Corp., Glenbrook, Conn.
SATELLITE YAW SENSOR STUDY PROGRAM Final Report
Jul. 1969 139 p refs
(Contract NAS9-7999)
(NASA-CR-101861) Avail: CFSTI CSCL 22B

The preliminary design, breadboard construction, and test results are presented for the sensor to measure satellite yaw with respect to the surface of the earth or moon, in daylight or darkness. The core of the sensor is an electro-optical pattern matching or correlating device consisting of a scanner assembly that scans an area on the ground and converts the viewed scene into an electrical analog, a memory system that can store one or more signatures, and a correlator that compares two signatures for degree of similarity. An evaluation and analysis of best available information indicates the adequacy of thermal gradients even under worst case conditions (over the earth's oceans and just before lunar dawn). The effect of roll rate was analyzed and shown to be easily overcome. The IR sensitivity was calculated to be 9 times better than originally calculated. The yaw angular sensitivity of the system was demonstrated to be at least two times better than originally calculated. Author

N69-35919# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES, FEBRUARY 1969
R. D. Eberst 20 May 1969 23 p
(ROE-STS-86) Avail: CFSTI

Tables of satellite stopwatch observations from various stations, giving right ascension, declination, angular accuracy, epoch of position coordinates, stellar magnitude, and flash period are presented. ESRO

N69-35925*# National Aeronautics and Space Administration, Washington, D.C.
AMERICA IN SPACE: THE FIRST DECADE. NASA SPACECRAFT
[1968] 26 p
(NASA-EP-54) Avail: SOD $0.50; CFSTI

Spacecraft subsystems are briefly described and mission and performance data are recapitulated for major NASA sounding rocket, satellite, and space probe spacecraft series. E.C.

N69-35935*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RESEARCH AND ADVANCED DEVELOPMENT. VOLUME 1: (OSSA) Semiannual Review, 1 Jul. – 31 Dec. 1968
15 Feb. 1969 359 p refs
(Contract NAS7-100)
(NASA-CR-105419; JPL-701-23-Vol-1) Copyright. Avail: CFSTI CSCL 22B

The areas of supporting research and technology which are discussed in detail are spacecraft applications, launch vehicles, planetary exploration and science, physics and astronomy, data analysis, bioscience, lunar science, Apollo spacecraft, and AAP definition. Emphasis is placed on planetary qusrantine and spacecraft and capsule equipment. N.E.N.

N69-35983# Deutsche Versuchsanstalt Fur Lufe und Raumfahrt Oberpfaffenhofen (West Germany). Satelliten-Kontrollzentrum.
PROGRESS REPORT ON AZUR SATELLITE [STAND DER ARBEITEN FUER DAS PROJEKT AZUR]
Martin Schurer *In its* DVL News, No. 39 Mar. 1969 p 457-458 In GERMAN (See N69-35976 20-34)
Avail: CFSTI

A short survey is given on the state of development of the ground control center for the German AZUR satellite, and of integration tests carried out on the satellite. ESRO

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N69-34667# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
ON THE ANALYSIS OF COLUMN AND PLATE STABILITY EXPERIMENTS
R. L. Carlson and S. C. Bailey Dec. 1968 55 p refs
(Contract DAHC04-68-C-0004; Proj. Themis)
(AD-688559; GIT-EAR-68-8) Avail: CFSTI CSCL 20/11

An analysis of experiments performed on columns of variable cross-section, columns with various boundary conditions and plate elements with nonuniform prebuckle stress states is made. Data from experiments on plate elements in which the prebuckle stress state is nonuniform indicate that the conditions necessary for the applicability of the Southwell method are satisfied for the two types of specimens tested. Author (TAB)

N69-34698*# National Aeronautics and Space Administration, Washington, D.C.
HANDBOOK OF ELASTIC STABILITY
Kuranishi Masatsugu, Nakatakao, Yoshiki Masao, Hayashi Shigeru, Sugano Makoto et al Jul. 1969 796 p refs Transl. into ENGLISH from the book "Cone Dansei Antei Yoran" Tokyo, Corona Press, 1958 p 1-686 Revised
(NASA-TT-F-12172) Avail: CFSTI CSCL 20K

An exhaustive mathematical treatment of the problem of elastic stability is presented. Direct and specific solutions are provided in formula and tabular form for each type of member (plate shell). Problems in the plaster area are discussed in considerable depth. General methods and numerical examples in the determination of the buckling load are also presented. Author

N69-34744*# Rochester Applied Science Associates, Inc., N.Y.
A METHOD FOR ANALYZING THE AEROELASTIC STABILITY OF A HELICOPTER ROTOR IN FORWARD FLIGHT
Peter Crimi Washington NASA Aug. 1969 110 p refs
(Contract NAS1-74-11)
(NASA-CR-1332; RASA-68-10) Avail: CFSTI CSCL 01A

The exact solution to the perturbation equations of motion of a rotor in forward flight is studied. Effects of compressibility, stall, and reversed flow are taken into account, and there is no restriction on the number of degrees of freedom which can be analyzed. The equations of motion of a rotor blade in forward flight were derived in terms of the normal modes of free vibration of the blade. Aerodynamic forces were expressed on the basis of quasi-steady flow, using strip theory. Perturbation equations were generated by expanding all aerodynamic forces in the perturbation variables about their steady-state values. The equations are of the form of a coupled set of linear, second-order differential equations with periodically varying coefficients. A method was then developed for analyzing the stability of linear dynamic systems with periodically varying parameters. Stability is determined by calculation of all the characteristic values of the system. Author

N69-34747*# Mechanical Technology, Inc., Latham, N.Y.
DYNAMIC RESPONSE OF A DOUBLE SQUEEZE-FILM THRUST PLATE

T. Chiang, Coda H. T. Pan, and H. G. Elrod, Jr. Nov. 1968 29 p refs
(Contract NAS8-11678)
(NASA-CR-98332; MTI-68TR56) Avail: CFSTI CSCL 20K

The synchronous response of squeeze-film bearings with very high squeeze number was investigated. For the sake of simplicity, the geometry of a double squeeze-film circular disk was chosen. Three methods of solution are presented: a harmonic, a linearized harmonic, and an exact numerical solution. It was found that the dynamic response is mainly synchronous, with sub-harmonic responses negligibly small in magnitude. Squeeze-film damping occurs only in the edge region and is of the order of $1/\sqrt{\sigma}$. The damping can be neglected for large squeeze numbers. At high squeeze frequency, the response is 180° out of phase with the squeeze action, thus enhancing it and increasing the load capacity and stiffness. The converse is true for low frequencies. The harmonic solution for the dynamic response without linearization agrees well with the exact numerical solution, while the linearized harmonic solution agrees only qualitatively with it. K.W.

N69-34888# Sandia Corp., Livermore, Calif. Applied Mechanics Div.
ANALYSIS OF SHALLOW SPHERICAL CANTILEVERED SHELLS AND SHALLOW SPHERICAL DOMES WITH POLAR OPENINGS UNDER SYMMETRICALLY DISTRIBUTED LOADS
Omer A. Fettahlioglu Mar. 1969 186 p refs
(Contract AT(29-1)-789)
(SCL-RR-68-26) Avail: CFSTI

A mathematical analysis of the stresses and deflections in thin shallow spherical shells subjected to rotationally symmetrical distributed loads is presented. The shells are considered to be of constant thickness and isotropic construction and to be supported continuously either near the apex or along the outer boundary by a rigid ring. A simplified yet accurate analysis is accomplished by the application of bending shell theory. The equations are specialized to provide solutions for either fixed or simply supported structures. Results are presented in the form of non-dimensional curves which provide stresses and deflections in the most general form. Author (NSA)

N69-34970*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LONGITUDINAL MASS-SPRING MODELING OF LAUNCH VEHICLES
Rudolf F. Glaser Washington Aug. 1969 37 p refs
(NASA-TN-D-5371) Avail: CFSTI CSCL 22B

To determine longitudinal axisymmetric vibration modes of launch vehicles, simplified models must be established. Application of Galerkin's method to the equations of motion of the above simplified system is proposed, using the container-liquid modes with special normalization factors as coordinate functions. The resulting model is based on the energy law. The use of the container-liquid modes, results in accurate representation of significant structural and inertial characteristics of the container-liquid system. The special normalization of the coordinate functions converts the container-liquid systems directly in lumped parameter systems, having a number of degrees of freedom equal to the number of coordinate functions used. The containers are assumed cylindrical membranes with flat, rigid bottoms. For simplicity, typical tandem parts of vehicles, consisting of only one or two solid masses and springs and one liquid-filled container, are examined. Because of the rapid decrease of the equivalent modal masses (with increasing mode number), restriction to one-term approaches does not mean considerable loss of accuracy. Comparison of analytical results with experiments provides satisfactory agreement. Author

N69-35088# Catholic Univ. of America, Washington, D.C.
RESPONSE OF RATE-SENSITIVE FRAMES TO IMPULSIVE LOAD
Nicholas Perrone Jun. 1969 27 p refs To be presented at the ASCE Dyn. Plasticity Meeting, Chicago, Oct. 1969
(Grant NSF GK-2082)
(Rept-11) Avail: Issuing Activity

The response of frames made of rate sensitive material and subjected to high intensity loading is determined in an approximate way by utilizing modal approximations and plastic hinges with an effective length of 3 beam depths. An initial modal deformation pattern is assumed and a tentative associated solution obtained. Should the solution turn out not to be valid (or safe) a new modal pattern is assumed and the process repeated. The square portal frame under horizontal impulsive impact is treated in detail. The results show that if the impulsive velocity is less than some limiting value, a simple side sway motion is the correct one; if this critical velocity is exceeded, the horizontal member bows out due to centrifugal inertia force. Extension of the technique discussed here to account for strain hardening and pressure pulse loading on frames is also considered. Author

N69-35184# Columbia Univ., New York. Dept. of Civil Engineering and Engineering Mechanics.
REMARKS ON A STUDY OF A 'NEW' PROCEDURE FOR THE STATISTICAL EVALUATION OF DESIGN CRITERIA
Colin Brown Mar. 1969 21 p refs
(Contract Nonr-266(91))
(AD-688437; TR-62) Avail: CFSTI CSCL 1/3

The report is an evaluation of the three volume work entitled Quantitative Structural Design Criteria By Statistical Methods by Bouton et al. TAB

N69-35198# Columbia Univ., New York. Dept. of Civil Engineering and Engineering Mechanics.
A STRESS-TRADIENT-DEPENDENT YIELD CONDITION
P. Gou and A. M Freudenthal Mar. 1969 23 p refs
(Contract Nonr-266(91))
(AD-688436; TR-60) Avail: CFSTI CSCL 13/13

A modified von Mises condition in which effects of the stress gradients are introduced is formulated and applied to simple problems of bending, torsion and the spherical shell under internal pressure. Author (TAB)

N69-35199# Lockheed Missiles and Space Co., Sunnyvale, Calif.
ON THE BEHAVIOR OF CONICAL SHELLS UNDER DYNAMIC LOADING
M. A. Shumik [1968] 3 p refs Transl. into ENGLISH from Prikl. Mekh. (USSR), v. 5, no. 6, 1969 p 15-19
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The stability of closed and truncated conical shells with any rise under dynamic loading by external pressure is studied. It is assumed that the shell has initial imperfections characterized by the deflection. Inertial loads corresponding to a displacement in the normal direction to the surface are taken into account in solving the problem. It is shown that the dependence of the critical dynamic pressure on the geometric and mechanical parameters of the shell is determined by the loading law, and that shells with angles α close to $\pi/2$ are most stable at high loading rates. P.O.S.

N69-35221# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
TEMPERATURES AND THERMAL STRESSES IN THIN-WALLED SPHERICAL SEGMENTS

Brice N. Cassenti and S. V. Nardo Jun. 1969 92 p refs
(Contract N00014-67-A-0438)
(AD-688433; PIBAL-69-20) Avail: CFSTI CSCL 20/11

The thermal stresses induced in thin-walled spherical shell segments, subject to a uniform aerodynamic heat input are presented. The problem is divided into two main sections: determination of the transient and steady-state temperature distribution in the spherical shell segment, and calculation of the resulting thermal stresses. Author (TAB)

N69-35245*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEVELOPMENT OF NONDESTRUCTIVE TEST DEVICE FOR EVALUATION OF 3/4-INCH THICK POLYURETHANE SPRAY-ON FOAM INSULATION (SOFI) ON THE SATURN S-2 STAGE
John Haynes and H. S. Haralson 1 May 1969 40 p refs
(NASA-TM-X-53852) Avail: CFSTI CSCL 20M

The technical survey, research development, and applied engineering effort, performed to develop a nondestructive test for evaluation of the cryogenic insulation used on the Saturn S-2 stage, are described. Several methods of testing were studied but the sonic impedance method was determined to be the most favorable. Since the sonic impedance method was capable of locating defects in the insulation smaller than specifications limitations, it is recommended for inspecting the insulation on the S-2 stage liquid hydrogen tanks. Author

N69-35284# General Technology Corp., Lawrenceville, N.J.
FURTHER ANALYSIS OF TWO NORMALLY INTERSECTING CYLINDRICAL SHELLS SUBJECTED TO INTERNAL PRESSURE
Richard F. Maye and A. Cemal Eringen Apr. 1969 53 p refs
(Contract N00024-68-C-5346)
(AD-688462; TR-3-10) Avail: CFSTI CSCL 13/13

The report discusses the theoretical analysis of two normally intersecting cylindrical shells considered to be infinitely long, closed at their ends, and subjected to internal pressure. Author (TAB)

N69-35481*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
CYROGENIC STRETCH FORM BOTTLE TEST PROGRAM Final Report
T. R. Alchorn Huntsville, Ala. NASA. Marshall Space Flight Center 3 Mar. 1969 105 p
(Contract NAS8-21482)
(NASA-CR-61294; LMSC-73427) Avail: CFSTI CSCL 20L

A description is presented of the testing performed on three pressure vessels fabricated with cryogenic forming techniques for the purpose of verifying the reliability of the technology to produce bottles having high weld efficiency for use in a cryogenic aerospace application. Testing included high and low temperature cycling with pressure applied both pneumatically and hydraulically, culminating in burst of the vessels at cryogenic temperature. Author

N69-35483*# National Aeronautics and Space Administration, Washington, D.C.
A METHOD FOR COMPUTING NATURAL OSCILLATION MAGNITUDES FROM THE RESULTS OF VIBRATION TESTING IN AN EXCITER CONFIGURATION [EIN VERFAHREN ZUR RECHNERISCHEN ERMITTLUNG DER EIGENSCHWINGUNGSGROSSEN AUS DEN ERGEBNISSEN EINES SCHWINGUNGSVERSUCHES IN EINER ERREGERKONFIGURATION]
H. Guenther Natke (Ph.D. Thesis Technische Hochschule Munchen, 4 Dec. 1968) Aug. 1969 90 p refs Transl. into ENGLISH from a German dissertation
(NASA-TT-F-12446) Avail: CFSTI CSCL 20K

The phase separation method is derived and critically discussed as a way to separate the natural vibrating modes of an undamped system. Methods recommended by others are cited for comparison. An analytical method is reported for determining the natural frequencies, shapes of vibration, effective dampings and generalized masses. Author

N69-35510# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EQUATIONS OF THE TWO-DIMENSIONAL PROBLEM OF THE VARYING-STRENGTH OF VARYING MODULI THEORY OF ELASTICITY
S. A. Ambartsumyan 17 Jan. 1969 35 p refs Transl. into ENGLISH from Izv. Akad. Nauk Arm. SSR, Mekhan. (Yerevan), v. 19, no. 2, 1966 p 3–19
(AD-687633; FTD-HT-23-1156-68) Avail: CFSTI CSCL 20/11

Assumption is made of a material having constant but different moduli of elasticity in tension and compression. Likewise the Poisson ratios are different in tension and compression. For materials with such properties all the elasticity equations, the equations of compatibility, equations of equilibrium, and the generalized Hookes law are derived and compared with the classical theory equations. For the two-dimensional case, besides the rectangular coordinates, the author uses also polar coordinates. It is shown that the Castigliano theorem is valid for the two-moduli theory as well. TAB

N69-35515*# Philco-Ford Corp., Newport Beach, Calif. Space and Re-entry Systems Div.
STRUCTURAL OPTIMIZATION OF SANDWICH AND RING-STIFFENED 120 DEGREE CONICAL SHELLS SUBJECTED TO EXTERNAL PRESSURE
Gerald A. Cohen Washington NASA Aug. 1969 70 p refs
(Contract NAS1-5554-6)
(NASA-CR-1424) Avail: CFSTI CSCL 20K

A practical optimum design procedure is developed for lightly loaded shells of revolution of both sandwich and ring-stiffened construction. For ring-stiffened shells, this procedure employs a design computer program as well as shell prebuckling and buckling analysis programs. Specific point designs for 120° truncated cones are obtained over a wide range of critical pressure for two base radii. The results show that for low loading, ring-stiffened construction is more efficient than sandwich construction. Author

N69-35627# Hauser Research and Engineering Co., Boulder, Colo.
EFFECTS OF THERMAL CYCLING ON BIAXIALLY STRESSED BALLOON FILMS
Natl. Center for Atmospheric Res. Jul. 1969 58 p refs Sponsored by NSF
(NCAR-TN-41) Avail: Issuing Activity

Ultimate biaxial strength properties of balloon films at +23 and -80°C were found for 0.7 mil Winzen StratoFilm and 0.75 mil VisQueen X-124. Biaxial prestress of specimens past the room temperature yield point was found to decrease maximum tensile strength at -80°C. Biaxial prestress of specimens at -80°C produces some increase in room temperature tensile strength. Ultimate biaxial elongation was not strongly affected by prestress in either environment. Author

N69-35842*# National Aeronautics and Space Administration, Washington, D.C.

NATURAL VIBRATIONS AND AEROELASTIC STABILITY OF A RECTANGULAR PANEL WITH FLEXIBLE SUPPORTS [VIBRAZIONI PROPRIE E STABILITA AEROELASTICA DI UN PANNELLO RETTANGOLARE CON APPOGGI FLESSIBILI]

G. Quozzo Aug. 1969 15 p refs Transl. into ENGLISH from Ric. Sci. (Rome), v. 38, no. 4, 1968 p 396–404
(NASA-TT-F-12453) Avail: CFSTI CSCL 20K

The parameters affecting panel flutter are analyzed, with the objective of improving agreement between theory and experiment. Of particular importance is the behavior of the structures to which the panel is attached, since the latter is secured to a flexible rather than a rigid support. The general problem involves complex nonlinear phenomena, to which factors of aerodynamic and structural damping also contribute. The influence of support flexibility on the aeroelastic stability of the panel is examined for the case where the supports are perpendicular to the streamline and where they are parallel to it. In addition, the natural vibration modes of such a panel are analyzed. A.C.R.

N69-35647# Shock and Vibration Information Center (Defense), Washington, D.C.

THE SHOCK AND VIBRATION DIGEST, VOLUME 1, NO. 3

1969 26 p refs
(AD-688401) Avail: CFSTI CSCL 20/11

The report presents abstracts of papers and reports on the general subjects of lubrication and shock and vibration. TAB

N69-35655*# Brown Univ., Providence, R.I. Center for Dynamical Systems.

ON THE STABILITY OF A COLUMN SUBJECTED TO A TIME-DEPENDENT AXIAL LOAD

E. F. Infante and R. H. Plaut [1969] 13 p refs
(Grants NGR-40-002-015; DA-ARO(D)-31-124-G270; AF-AFOSR-693-67)
(NASA-CR-105320) Avail: CFSTI CSCL 20L

The dynamic stability of a linear elastic column under a time-varying axial load is investigated. The form of stability considered is almost-sure asymptotic in case the load is assumed to be stochastic; if the load is assumed to be deterministic, the stability is asymptotic in the sense of Liapunov. Almost-sure asymptotic stability is assumed because this appears to be the more natural mathematical concept for this type of physical problem. Simultaneously with the conditions for asymptotic stability, the measures of exponential decay of the solutions are obtained. These results are first obtained by the modal approach; but since this procedure is mathematically questionable, it is shown that the same estimates and conditions for almost-sure asymptotic stability can be obtained in a simple and direct manner from the original partial differential equation. The results are compared with those published previously. K.W.

N69-35698# Sandia Corp., Livermore, Calif. Analytical Mechanics Div.

MEMBRANE AND EDGE EFFECT SOLUTIONS OF FILAMENT-WOUND SHELLS OF REVOLUTION

Osmer A. Fettahlioglu May 1969 78 p refs
(Contract AT(29-1)-789)
(SCL-DR-68-112) Avail: CFSTI

A method for analyzing stresses and displacements in filament-wound shells of revolution is presented. This method of analysis is based on the membrane theory of shells but incorporates the edge effect theory to predict a more realistic behavior in the vicinity of polar openings. In addition, because it includes the contribution of the matrix, the present membrane theory is more accurate for the analysis of shells under nondestructive operating loads than is the so-called netting analysis which considers the filaments to be the only load-carrying members. The membrane theory is also modified to give accurate solutions in the shallow region of composite shells and indicates significant bending stresses due to orthotropy and the shape of the meridian. While these stresses are localized near the apex in thin shells, they may extend well down along the meridian in thick shells. Author (NSA)

N69-35772# Texas Transportation Inst., College Station.

FATIGUE ANALYSIS OF THE CAST ALUMINUM BASE Research Report

Hayes E. Ross, Jr., Thomas C. Edwards, and Gerald R. Babb Aug. 1968 32 p refs Prepared in cooperation with Bur. of Public Roads
(PB-183488; RR-75-11) Avail: CFSTI CSCL 13B

The report discusses fatigue analysis of cast aluminum transformer bases. The fatigue is caused by wind induced vibrations and data for two pole configurations are presented. USGRDR

N69-35882# Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.

FREE VIBRATIONS OF CIRCULAR CYLINDRICAL SHELLS

Anthony E. Armenakas (Polytech. Inst. of Brooklyn), Demos C. Gazis (IBM Corp, Yorktown Heights, N.Y.), and George Herrmann Apr. 1969 223 p refs Prepared in cooperation with the Polytechnic Inst. of Brooklyn and IBM Corp., Yorktown Heights, N.Y.
(Grant AF AFOSR-100-64)
(AD-688902; AFOSR-69-1539TR) Avail: CFSTI CSCL 13/13

Essentially a compilation of tables giving frequencies and mode shapes of vibrating cylindrical shells, the book is written for research and development engineers as well as for active scientists working in wave propagation and dynamics of thin shells. The text includes a self-contained treatment of the problem of propagation of plane harmonic waves along a hollow circular cylinder, within the framework of the three-dimensional theory of elasticity. The tables present frequencies of free vibrations of such cylinders for a wide range of axial and circumferential wave-lengths and of shell dimensions. In addition, graphs of frequency spectra and associated mode shapes are included. Author (TAB)

N69-35899# Lockheed Missiles and Space Co., Palo Alto, Calif.

ON THE STABILITY OF SHELLS OF NONCIRCULAR TRANVERSE SECTION WITH CURVILINEAR GENERATORS UNDER AXIAL COMPRESSION

I. N. Ginzburg 1969 8 p refs Transl. into ENGLISH from Prikl. Mekh. (Kiev), v. 5, no. 6, 1969 p 7–14
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Previous calculations are extended to the case of shells with noncircular cross section subjected to axial compressive loads. These analyses indicate that all deductions made for shells of circular cross section with curvilinear generators carry over to those of noncircular section. The presence of curvilinear generators for shells of negative Gaussian curvature results in an abrupt reduction in the critical axial compressive stress, even for a slight deviation of the generators from the straight line shape. In addition, the cause of critical force reduction observed experimentally is also explained by the presence of such generators, when the ratio of the cross sectional radius to the wall thickness increases. A.C.R.

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N69-34675# Centre National de la Recherche Scientifique, Bellevue (France). Lab. des Hautes Pressions.

CONTRIBUTION TO EXPERIMENTAL STUDY OF THERMAL CONDUCTIVITY OF SOME FLUIDS AT HIGH TEMPERATURE AND HIGH PRESSURE [CONTRIBUTION A L'ETUDE EXPERIMENTALE DE LA CONDUCTIVITE THERMIQUE DE QUELQUES FLUIDES A HAUTE TEMPERATURE ET A HAUTE PRESSION]

B. Le Neindre (Ph.D. Thesis--Paris Univ.) 1969 232 p refs In FRENCH

Avail: CFSTI

A descriptive and critical survey of different methods used to measure the thermal conductivity of gases is presented. A device based on the coaxial cylinder method is presented. The use of this device up to 700°C and 1000 bars is discussed. The accuracy of the measurement is evaluated and results gained are presented for argon up to 700°C and 1000 bars, helium up to 500°C and 1000 bars, hydrogen at 30°C as a function of pressure and at 100 bars as a function of temperature, nitrogen up to 500°C and 1000 bars, carbon monoxide up to 700°C and 1000 bars and methane and ethane up to 450°C and 1000 bars. ESRO

N69-34710*# Wisconsin Univ., Madison. Dept. of Mechanical Engineering.

THEORY OF DROPLET VAPORIZATION IN THE REGION OF THE THERMODYNAMIC CRITICAL POINT

Jose A. Manrique 2 Jun. 1969 98 p refs

(Grant NGR-50-002-017)

(NASA-CR-72558) Avail: CFSTI CSCL 20M

Analysis of the vaporization of a spherical droplet in a stagnant inert atmosphere including property variations with temperature and pressure and surface regression is applied by numerical computation to the case of liquid carbon dioxide vaporizing in gaseous nitrogen. Ambient temperatures of 375° to 1600°K and pressures of 70 to 120 atmospheres were used in the calculations. Non-ideal effects are shown to be important. It is shown that for sufficiently high pressures no steady-state exists, and that a droplet can reach and exceed its critical temperature by an intrinsically unsteady process. Comparisons are made with low density film theories and film theory with properties corrected for non-ideal effects. Some calculations of the effects of sinusoidal pressure oscillations on vaporization are also included. Author

N69-34892*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SOLID-PROPELLANT COMBUSTION INSTABILITY AND THE ROLE OF VELOCITY COUPLING

Louis A. Povinelli Washington Aug. 1969 50 p refs

(NASA-TN-D-5395) Avail: CFSTI CSCL 21B

This report is concerned with the role of pressure and velocity coupling in solid propellant combustion instability. The status of knowledge is reviewed, including current efforts directed toward improving propellant response theory. Recent work on driving mechanisms indicates the importance of velocity on the coupling process. The advantages and disadvantages of using the vortex burner and the T-burner for making response measurements are discussed. New results from the vortex burner are presented, regarding the effect of burning rate catalyst and aluminum oxide on the occurrence and severity of combustion instability. The relevance of the research results to rocket motors is discussed. Author

N69-34918# West Virginia Univ., Morgantown. Engineering Experiment Station.

DIGITAL COMPUTER SOLUTION OF COMPLEX TRANSIENT HEAT TRANSFER PROBLEMS Technical Bulletin No. 62

J. T. Anderson, J. M. Botje (GE, Cincinnati), and W. K. Koffel (GE, Cincinnati) 1968 29 p refs

(TB-62; PB-183264) Avail: CFSTI CSCL 20M

A finite difference method has been developed and programmed for a digital computer for solving complex transient heat transfer problems. Arbitrary geometrical configurations involving both solids and stagnant or flowing fluids are broken into as many as 200 nodes which exchange heat by convection, conduction, contact resistance, solid and gaseous radiation, surface flux and internal heat generation. Input consists of geometrical data, material identification, radiation configuration factors and boundary conditions. Boundary conditions may be specified as functions of either time or temperature. Material properties are stored internally as functions of temperature. Author (USGRDR)

N69-34931# Atomic Weapons Research Establishment, Aldermaston (England).

TEMPERATURE DISTRIBUTIONS ON CONDUCTION-COOLED MICROCIRCUIT SUBSTRATE SURFACES BY RELAXATION ANALYSIS

D. J. Dean and J. C. Taylor Feb. 1969 22 p refs

(AWRE-O-9/69) Avail: CFSTI: HMSO: 3s 3d

A new physical model is introduced to allow the accurate calculation of substrate surface temperatures by relaxation analysis. Simple two- and three-dimensional distributions may be calculated manually, and a specific example is calculated to an accuracy of 1%. More complex situations are readily amenable to computer techniques. Author (NSA)

N69-34954# Sandia Corp., Albuquerque, N. Mex.

THERMAL CONDUCTIVITY IN SMALL AIR GAPS AT VERY LOW PRESSURES

H. C. Hardee and W. R. Green Jul. 1968 13 p refs

(PB-183165; SC-TM-68-309) Avail: CFSTI CSCL 20M

An analysis was made to determine the pressure conditions which must exist in narrow air gaps for the thermal conductivity to be significantly lowered and to determine the time required for these conditions to be reached in a typical system. The air flow calculations were confimed with a test and it is concluded that the proper conditions can be achieved only in the most specialized cases. Author (USGRDR)

N69-34986*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

CHEMICAL EQUILIBRIUM OF ABLATION MATERIALS INCLUDING CONDENSED SPECIES

C. W. Stroud and Kay L. Brinkley Washington Aug. 1969 41 p refs

(NASA-TN-D-5391) Avail: CFSTI CSCL 20M

A computer program for calculating the multiphase chemical equilibrium of an arbitrary system is described and the complete program is included as an appendix. This program was used to calculate the chemical equilibrium of low-density phenolic nylon over a wide range of conditions. The effects of including carbon in the condensed phase on equilibrium composition and ablative performance are discussed. Methods for incorporating the important effects of chemical equilibrium into ablation analyses are described. Author

N69-35068# California Univ., Livermore. Lawrence Radiation Lab.
COMPILATION OF THERMAL PROPERTY DATA FOR COMPUTER HEAT CONDUCTION CALCULATIONS
A. L. Edwards 24 Feb. 1969 78 p ref Sponsored by AEC
(UCRL-50589) Avail: CFSTI

Thermal property data including density, specific heat, and thermal conductivity was tabulated against temperature, transition temperatures, and latent heats of transition for more than 1000 materials. These data were collected from over 50 references, most of which contain extensive data tabulations and bibliographies. The data were arranged on computer cards and magnetic tape in a format suitable for computer processing, with the materials identified numerically according to a general and flexible classification system. An accompanying alphabetical index describes each material, assigns it an identification number, references the sources of the data by code number, and codes the quality or reliability of the data. The gram-cm-sec-cal-°C unit system is used for all data. A computer program was written to search the material data list for specific material identification numbers and to convert the data to a new unit system and transfer the selected data to another tape. This second tape, in turn, can be used either as an input tape or as a means for producing punched cards. Author (NSA)

N69-35098# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
A CORRELATION OF FIELD OBSERVATIONS OF PLUME RISE
James A. Fay, Marcel Escudier, and David P. Hoult Apr. 1969 30 p refs
(Grant PHS-G-AP-00678-01)
(Pub-69-4) Avail: Issuing Activity

Data from 137 sets of plume observations, comprising nearly 1500 data points, are correlated with two simple formulas. These formulas, one for the buoyancy dominated rise region and the other for the stratification dominated leveled off region of a plume, represent an approximate form of an entrainment theory for the case of uniform atmospheric stratification and zero wind shear. The observations were made of plumes whose source strengths ranged from 0.4 to 111 MW and which were emitted from stacks of heights between 21 and 183 m. The two formulas are found to correlate the data equally well over all values of the stack exit and meteorological parameters, provided only that the bulk mean velocity of the stack gases exceeds the mean wind speed by at least 20 percent. Based upon the correlation, two formulas are recommended for computing median plume rise at all distances downstream of the stack. The formulas include an estimate of the expected uncertainty in the predicted rise. Author

N69-35164# Politecnico di Torino (Italy). Istituto di Macchine e Motori per Aeromobili.
THEORETICAL ANALYSIS AND EXPERIMENTAL VERIFICATION OF PRESSURE LOSSES IN A COMBUSTOR OF A GAS TURBINE [ANALISI TEORICA E VERIFICA SPERIMENTALE DELLE PERDITE DI PRESSIONE NEI COMBUSTORI DI TURBINE A GAS]
L. Verduzio and P. Campanaro Jun. 1968 43 p refs In ITALIAN
(Contract CNR-115-0375-0-0666)
(Publ-97) Avail: CFSTI

A theoretical method for the determination of pressure losses in the combustor of a gas turbine engine is discussed. The total loss is attributed to losses during heat exchange and to fluiddynamic losses. The problem is examined both with and without combustion and in the latter the heat production is not taken into account. The predictions are compared with the results of many experimental tests carried out on a specially designed combustion chamber. ESRO

N69-35170# Eppley Lab., Inc., Newport, R.I.
CONTINUATION OF EXPERIMENTAL INVESTIGATIONS OF LOW-TEMPERATURE RADIATION SOURCES Final Report, Phase 1
30 Jun. 1968 49 p refs
(Contract E-75-68N)
Avail: Issuing Activity

Cryogenic techniques are evaluated for employment in thermoelectric heat pumping and in achieving black body temperatures between −50° and +50°C for radiometric calibration of instruments. Efforts to extend the black body temperature range from that attainable with thermoelectric controlled units to the liquid nitrogen range resulted in a cavity array design or radiator configuration that can be considered a flat black plate of unit emissivity. The use of miniaturized cryogenic refrigerators for black body radiation cooling and experimental progress in the development of design parameters for such a cooling source are described. G.G.

N69-35349# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Lampoldshausen (West Germany). Institut für Chemische Raketenantriebe.
MODERN ASPECTS AND METHODS IN ANALYZING THE UNSTABLE PROCESSES IN LIQUID ROCKET ENGINES [NEUERE ASPEKTE UND METHODEN ZUR ANALYSE DER INSTABILEN VORAENGE IN FLUESSIGTREIBSTOFF-RAKETENBRENNKAMMERN]
H. G. Ruppik Apr. 1969 162 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. für Wiss. Forsch.
(BMwF-FB-W-69-16) Avail: CFSTI

A comparative review of recent advances in the analyses of unstable combustion in liquid rocket engines is attempted and the majority of accessible publications are summarized and discussed. Combustion instability which has been frequently observed and the characteristics of various types of instability, including shock and detonation waves are treated. The possible causes and driving mechanisms of combustion instability, stability criteria, nonlinear aspects and damping mechanisms are considered, as well as the possibility of applying unstable combustion to produce thrust. A comprehensive bibliography is appended. Author (ESRO)

N69-35367*# Israel Program for Scientific Translations, Ltd., Jerusalem.
CALCULATION OF THE COMPOSITION AND THERMODYNAMIC FUNCTIONS OF GENERAL REACTING GASEOUS SYSTEMS
I. B. Rozhdestvenskii, V. P. Shevalev, and K. K. Olevinskii *In its* High-Temp. Properties of Gases. Phys. Gas Dyn., Thermodyn., and Phys. of Combust. 1969 p 14–22 refs (See N69-35365 20-12)
Copyright. Avail: CFSTI CSCL 20M

The thermodynamic functions of an ideal reacting gaseous system at high temperature are derived by forming a mathematical model from equations of chemical equilibrium. The selected matrix of initial information for the gaseous composition is transformed into a transposed matrix consisting of molecules containing at least once any atom and not a linear combination of each other. Example calculations for atoms O,N,C, and negative electrons are considered in combinations CO_2, CO, N_2O+, and C_2N_2. When the mathematical model described is programmed into computer language, the program must yield thermodynamic quantities and composition of the mixture corresponding to the given temperature and pressure. G.G.

N69-35368*# Israel Program for Scientific Translations, Ltd., Jerusalem.
THERMODYNAMIC FUNCTIONS OF THE COMBUSTION PRODUCTS OF THE SYSTEM LIQUID ETHYL ALCOHOL-GASEOUS OXYGEN
I. B. Rozhdestvenskii, K. K. Olevinskii, and V. P. Shevelev *In its* High-Temp. Properties of Gaseous. Phys. Gas Dyn., Thermodyn., and Phys. of Combust. 1969 p 23–27 refs (See N69-35365 20-12)
Copyright. Avail: CFSTI CSCL 07D

This paper presents the $h - s$ diagram of the products of combustion for (for $\alpha = 1$), a graph of the composition of the combustion products as a function of α ($0.1 \leq \alpha \leq 3$) for the theoretical combustion temperature T_c and other curves. These data can be used in calculations regarding combustion chambers and the isentropic flow of the products of combustion. The data on the composition can be used for an improved calculation of the kinetic coefficients of the combustion products of the system. The computation was performed on a computer. Author

N69-35374*# Israel Program for Scientific Translations, Ltd., Jerusalem.
SHOCK-TUBE STUDY OF THE STAGNATION-POINT HEAT EXCHANGE OF A BLUNT BODY
Yu. A. Polyakov *In its* High-Temp. Properties of Gases. Phys. Gas Dyn., Thermodyn. and Phys. of Combust. 1969 p 71–78 refs (See N69-35365 20-12)
Copyright Avail: CFSTI CSCL 20M

Gas dynamic relations for a plane shock front propagating along a tube channel and the corresponding equations for detached compression shock are used to derive simulation conditions for heat transmission and stagnation parameters around a blunt body under flight conditions. Experimental results obtained by calorimeters on models of 12.7 mm diameter show that at altitudes of about 35 to 40 km the heat flux near the stagnation point increases by a factor of two as the flight velocity increases from 1 to 5 km/sec. Up to flight velocities of 8 km/sec the experimental results agree well with calculated values. G.G.

N69-35376*# Israel Program for Scientific Translations, Ltd., Jerusalem.
EXPERIMENTAL STUDY OF THE SPECTRAL PROPERTIES OF AIR AT HIGH TEMPERATURES
A. A. Kon'kov, A. P. Ryazin, and V. S. Rudnev *In its* High-Temp. Properties of Gases. Phys. Gas Dyn., Thermodyn. and Phys. of Combust. 1969 p 79–89 refs (See N69-35365 20-12)
Copyright Avail: CFSTI CSCL 20M

The temperature of air heated by a reflected shock wave was measured for Mach numbers of the incident shock wave between 20 and 30. Satisfactory agreement between experimental and theoretical data was observed up to Mach number 24, while for higher Mach numbers a systematic discrepancy existed between the measured and theoretical values of the temperature. This discrepancy, however, remained within the limits of the measurement errors. A comparison of the experimental and theoretical values of the spectral absorption coefficients of air established that the values used for the absorption cross section of the negative nitrogen ion were overestimated, and that the values used in for the absorption cross sections of the second positive nitrogen system were likewise overestimated. Calculation for the air absorption coefficients in the temperature range 100–2400°K and for the densities 10^{-6}–10^{1} of the normal are given. A comparison of all data showed that their numerical values are close. Author

N69-35385*# Israel Program for Scientific Translations, Ltd., Jerusalem.
IGNITION CONDITIONS IN COMBUSTIBLE GAS MIXTURES
A. S. Predvoditelev *In its* High-Temp. Properties of Gases. Phys. Gas Dyn., Thermodyn. and Phys. of Combust. 1969 p 137–147 refs (See N69-35365 20-12)
Copyright. Avail: CFSTI CSCL 21B

Spontaneous and induced ignition processes in quiescent gas mixtures are analyzed by determining chemical reaction rates by the change in the components of the gas mixture. Volterra equations are used to describe pressure fluctuations caused by cyclic reactions and kinetic equality of temperature and pressure regions. Ignition limits caused by pressure are determined by second order reactions. Ignition regions are defined by curves having three roots with respect to pressure. G.G.

N69-35386*# Israel Program for Scientific Translations, Ltd., Jerusalem.
VIBRATIONAL FLAME PROPAGATION IN A TUBE
G. D. Salamandra *In its* High-Temp. Properties of Gases. Phys. Gas Dyn., Thermodyn. and Phys. of Combust. 1969 p 148–152 (See N69-35365 20-12)
Copyright. Avail: CFSTI CSCL 07D

The vibrational propagation of the flame in circular tubes of 30 mm diameter, and cross section 36×36 mm^2 and 50×50mm^2 was investigated. Combustible mixtures consisted of rapidly burning hydrogen–oxygen mixtures and slowly burning carbon monoxide-air mixtures. The process was photographed in the first case by a high-speed SFR camera, and in the second case by the SKS-1 camera. The motion picture record was supplemented by the continuous photography of the process. The following conclusions were drawn from an analysis of the photographs: (1) The gas ahead of the flame is brought into motion by compression waves generated by the flame front. The gas velocity is constant along each of the disturbances. (2) The gas motion ahead of the flame front can be considered as one-dimensional. Author

N69-35437# ARO, Inc., Arnold Air Force Station, Tenn.
TABLES OF EQUILIBRIUM THERMODYNAMIC PROPERTIES OF AIR. VOLUME 2: CONSTANT PRESSURE Final Report, Jan. 1966–Jan. 1968
Herbert S. Brahinsky and Charles A. Neel AEDC Apr. 1969 280 p refs
(Contract F40600-69-C-0001)
(AD-686410; AEDC-TR-69-89-Vol-2) Avail: CFSTI CSCL 20/13

Equilibrium thermodynamic data are presented for air from a log P of −7.4 to 4.0 and from a temperature of 100 to 15,000K. Where P is pressure in atmospheres. These data are tabulated at constant pressure with temperature incremented. The dependent paramenters are log h/r, log rho, z, s/r, h/rt, and z*. Several sources were used in assembling the data. Author (TAB)

N69-35438# ARO, Inc., Arnold Air Force Station, Tenn.
TABLES OF EQUILIBRIUM THERMODYNAMIC PROPERTIES OF AIR. VOLUME 1: CONSTANT TEMPERATURE Final Report, Jan. 1966–Jan. 1968
Herbert S. Brahinsky and Charles A. Neel AEDC Apr. 1969 155 p refs
(Contract F40600-69-C-0001)
(AD-686409; AEDC-TR-69-89-Vol-1) Avail: CFSTI CSCL 20/13

Equilibrium thermodynamic data are presented for air from a temperature of 100 to 15,000K and from a log rho of −7.0 to 3.0, where rho is density in amagats. These data are tabulated at constant temperature with density incremented. The dependent parameters are z, e/rt, h/rt, s/r, log p, and z*. Several sources were used in assembling the data. Author (TAB)

N69-35439# ARO, Inc., Arnold Air Force Station, Tenn.
TABLES OF EQUILIBRIUM THERMODYNAMIC PROPERTIES OF AIR. VOLUME 4: CONSTANT TEMPERATURE WITH SPECIFIC HEAT AND SPEED OF SOUND DATA Final Report, Jan. 1966-Jan. 1968
Herbert S. Brahinsky and Charles A. Neel AEDC Apr. 1969 155 p refs
(Contract F40600-69-C-0001)
(AD-686411; AEDC-TR-69-89-Vol-4) Avail: CFSTI CSCL 20/13

Equilibrium thermodynamic data are presented for air from a temperature of 100 to 15,000K and from a log rho of −7.0 to 3.0, where rho is density in amagats. These data are tabulated at constant temperature with density incremented. The dependent parameters are log p, z, cp/r, cv/r, gamma, gamma e, and a/ae. Several sources were used in assembling the data. Author (TAB)

N69-35506*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL MEASUREMENTS OF EXPANDING STORABLE-PROPELLANT PRODUCTS SIMULATED BY COMBUSTION OF GASEOUS REACTANTS
Robert Friedman, Raymond E. Gaugler, and Erwin A. Lezberg Washington Sep. 1969 28 p refs
(NASA-TN-D-5404) Avail: CFSTI CSCL 21B

The storable system, 50-weight-percent unsymmetrical dimethylhydrazine and 50-percent hydrazine fuel with nitrogen tetroxide oxidizer, was simulated by combustion of hydrogen and methane with oxygen-enriched air in order to focus attention on the non-equilibrium expansion process. Static temperatures and pressures for the expanding combustion products, simulating a storable propellant equivalence ratio range of 0.9 to 1.4, were measured in a 5.6-area-ratio conical nozzle. Temperatures were nearly independent of oxidant-fuel ratio and were close to those calculated for frozen-expansion and kinetic analyses. Author

N69-35516*# Philco-Ford Corp., Newport Beach, Calif.
EVALUATION OF CONFIGURATION CHANGES ON OPTIMUM STRUCTURAL DESIGNS FOR A MARS ENTRY CAPSULE
Gerald A. Cohen Washington NASA Aug. 1969 51 p refs
(Contract NAS1-5554-5)
(NASA-CR-1414) Avail: CFSTI CSCL 20K

Optimum structural designs for Martian entry capsules are obtained for 140° blunted cone, 60° spherical dish, and 0A.65 tension shell configurations. These designs have 19 foot base diameters and are based on theoretical pressure and convective heat transfer distributions for orbit mode entry with a ballistic coefficient of 0.32 slug/Ft ^{2} Author

N69-35571*# Bendix Corp., Davenport, Iowa. Instruments and Life Support Div.
STUDY OF EXTERNAL INSULATIONS ON CRYOGENIC TANKAGE IN A THERMAL VACUUM CHAMBER Final Report, 19 Jan. 1968 - 15 Jul. 1969
31 Jul. 1969 248 p
(Contract NAS9-2978)
(NASA-CR-101868; Pub-4501-69) Avail: CFSTI CSCL 20M

Two methods by which existing dual wall vacuum insulated dewars can be insulated to meet future requirements involve dewar outer shell coatings and external laminar insulation. These methods were examined in this program, using a dewar of the discrete radiation shield - radial support bumper concept as the test article. Tests were performed with various outer shell coatings and external insulation wraps on the dewar in a simulated space environment, to determine relative thermal performances. Author

N69-35603# Politecnico di Torino (Italy). Istituto di Macchine e Motori per Aeromobili.
GAS PRESSURE MEASUREMENTS FOR KNOCK ANALYSIS [RILEVAMENTO DELLA PRESSIONE DEI GAS PER LA MISURA DELLA DETONAZIONE]
E. Antonelli Assoc. Tec. Automobile Jul. 1967 44 p refs In ITALIAN /ts Ric. ATA, Quaderno 2, Suppl. to No. 7
(Contract CNR-115-0375-200)
(Publ-90) Avail: CFSTI

Gas pressure and knock intensity measurements in internal combustion engines are discussed. The equipment included a pressure transducer and an oscilloscope for analyzing pressure variations and their derivatives. Experiments were performed using different types of adapters and spark plugs. ESRO

N69-35620# Politecnico di Torino (Italy). Istituto di Macchine e Motori per Aeromobili.
THEORETICAL EVALUATION OF AIR FLOW-RATE PENETRATING IN PRIMARY ZONE OF COMBUSTION FOR GAS TURBINES AND EXPERIMENTAL VERIFICATION OF RESULTS OBTAINED [VALUTAZIONE TEORICA DELLA PORTATA RICIRCOLANTE NELLA ZONA PRIMARIA DELLE CAMERE DI COMBUSTIONE PER TURBINE A GAS E VERIFICA SPERIMENTALE DEI RISULTATI OTTENUTI]
Leonello Verduzio and Paolo Campanaro Aug. 1968 44 p refs In ITALIAN; ENGLISH summary
(Contract CNR-115-0375-0-0868)
(Publ-101) Avail: CFSTI

A very simple theoretical model of the stabilization zone of a combustor with flame tubes is proposed in order to obtain the factors having influence on the air flow-rate, which comes from the stabilizing holes and penetrates in primary zone. The factors having a remarkable influence on it are: 1) number and diameter of the holes, grouped in the non-dimensional parameter $B = nd/2\,\Pi R_0$; 2) the ratio of the temperature in the primary zone to the temperature of the air penetrating in the flame tube; 3) the air/fuel ratio in the primary zone; 4) the air flow-rate introduced in the combustion zone upstream of the stabilizing holes; 5) the angle the air forms when it penetrates in the flame tube from the stabilizing holes. Following the proposed theoretical model a calculation method to determine this flow-rate approximately is proposed, and indications to use the method for combustor design are given. In order to give indications on the reliability of the proposed calculation method, some preliminary experimental tests are shown. They are qualitatively in a good agreement with the theoretical results. Quantitatively, differences that sometimes are remarkable, are found. The causes to which these differences are due, are unknown. Author (ESRO)

N69-35726# Politecnico di Torino (Italy). Istituto di Macchine e Motori per Aeromobili.
THE AIR RECIRCULATION RATIO IN CAN-TYPE GAS TURBINE COMBUSTION CHAMBERS
Leonello Verduzio and Paolo Campanaro Dec. 1968 28 p refs
(Publ-107) Avail: CFSTI

A theoretical model is proposed by which it is possible to calculate with a good accuracy the percent of air mass flow which, issuing from the stabilization holes, flows in the primary zone; on the base of the same model, the parameters, which have an influence on the mentioned flow-rate, are deduced. The analysis shows how one single parameter of correlation can be used for the comparison of flame tubes having different diameters and numbers of stabilization holes and with different diameters of the primary zone. Namely such a parameter is $B_1 = R_1/R_m$ where R_m is the radius of the flame tube of the primary zone, and R_1 is the radius of the circumference on which the jets flowing out from

the stabilizing holes loose their individuality merging with one another. The particular case of a combustion chamber without swirler and with jets entering the flame tube at right angle to the tube axis is examined. At constant inlet conditions and with the same pressure drop across the flame tube walls, the analysis shows that, for flame tubes having different diameters of the stabilizing holes but for a given number of them, the maximum air flow, entering the primary zone, is obtained with a particular value of the $d_o/2R_o$. When the number of holes is changed, the value of the maximum air flow recirculating changes, reaching its greatest value for $n = 6$ and $d_o/2R_o = 0.17$. In order to verify the reliability of the theoretical calculations the results of many experimental tests performed on very simple geometry combustors are reported. The comparison between the obtained experimental points and the theoretical results shows a very good agreement, taking into account the approximations involved in the theoretical approach and the difficulties of the experimental measurements. Author (ESRO)

N69-35742*# Techtran Corp., Glen Burnie, Md.
EMPIRICAL LAWS FOR HYBRID COMBUSTION OF LITHIUM HYDRIDE WITH FLUORINE IN SMALL ROCKET ENGINES [EMPIRISCHE GESETZE BEIM LITHERGOLEN ABBRAND VON LITHIUMHUBRID MIT FLOUR IN KLEINEN RAKFTENBRENNKAMMERN]
R. Lo Washington NASA Sep. 1969 43 p refs Transl. into ENGLISH from German Report DLR-FB-67-57, Sep. 1967 p 1–48
(Contract NASw-1695)
(NASA-TT-F-12336; DLR-FB-67-57) Avail: CFSTI CSCL 21B

Combustion studies of lithium hydride with fluorine resulted in the development of empirical time-dependent laws for various parameters of importance for the development of rocket engines with these propellants. Author

N69-35785# Aktiebolaget Atomenergi, Stockholm (Sweden).
THERMODYNAMIC ANALYSIS OF A SUPERCRITICAL MERCURY POWER CYCLE
A. S. Roberts, Jr. Apr. 1969 26 p refs
(AE-355) Avail: CFSTI

A heat engine is considered which employs supercritical mercury as the working fluid and a magnetohydrodynamic (MHD) generator for thermal to electrical energy conversion. The temperature range is approximately 300 to 2200°K and system pressure is 1500 atm. Equilibrium and transport properties are carefully considered since these are known to vary radically in the vicinity of the critical point, which is found near the supercritical states of interest. A maximum gross plant efficiency is 20% with a regenerator effectiveness of 90% and greater, a cycle pressure ratio of two, and with highly efficient pump and generator. However, certain specified cycle irreversibilities and others such as heat losses and heat exchanger pressure drops, which are not accounted for explicitly, reduce the gross plant efficiency to a few per cent. Experimental efforts aimed at practical application of the power cycle are discouraged by the marginal thermodynamic performance predicted by this study, unless such applications are insensitive to gross cycle efficiency. Author (ESRO)

N69-35808*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
GAS DYNAMIC PHENOMENA DURING THE DARK PHASE OF WIRE EXPLOSIONS AND THEIR IMPORTANCE FOR REIGNITION [UEBER DIE GASDYNAMISCHEN VORGAENGE WAEHREND DER DUNKELPAUSE VON DRAHTEXPLOSIONEN UND IHRE BEDEUTUNG FUER DIE WIEDERZUENDUNG]
W. Tiemann (Ph.d. Thesis - Tech. Hochschule Hannover, West Ger. - 1968) Washington NASA Aug. 1969 46 p refs Transl. into ENGLISH from the German
(Contract NASw-1692)
(NASA-TT-F-12430) Avail: CFSTI CSCL 20M

In analyzing the gas dynamic phenomena, the radial structure of the vapor cylinder and its temporal alteration as well as the discharge phenomena associated with reignition were experimentally investigated. It was found that the discharge phenomena in reignition are closely connected with the 3-dimensional structure of the metal vapor cylinder expanding during the dark phase. Schlieren photographs show the existence of an internal percussion wave converging onto the axis of the vapor cylinder; this wave is believed to determine the radial distribution of the variables of state in the metal vapor. Based on the discharge types observed in reignition results from the radial density distribution, it was concluded: (1) The first discharge type originated when the reignition takes place, before the vapor percussion wave is reflected in the axis of the vapor cylinder. The location of the ignition lies outside the axis directly in front of the percussion wave running inward. (2) The reignition takes place in the second discharge type only after the reflection of the vapor percussion wave and occurs precisely in the axis of the vapor cylinder. M.G.J.

N69-35811*# Lockheed Missiles and Space Co., Huntsville, Ala.
STUDY OF THERMAL CONDUCTIVITY REQUIREMENTS; MSFC 20-INCH AND 105-INCH CRYOGENIC TANK ANALYSES Interim Report
D. V. Hale NASA. Marshall Space Flight Center Jun. 1969 28 p refs
(Contract NAS8-21347)
(NASA-CR-61288; LMSC/HREC-D148760) Avail: CFSTI CSCL 20M

A thermal analyzer computer program is described, suitable for thermal analysis of venting cryogenic tanks, by incorporating the natural convection along the walls of the tank and the thermal effects of transfer of the venting gas. It is concluded that thermal analysis of venting insulated cryogenic tanks requires a proper treatment of the convective and mass flow effects of the venting gas and, because the natural convection exists in a gravity field, it is essential that it be included in the calculations. F.O.S.

N69-35864# Fenwal, Inc., Ashland, Mass.
STUDY OF FLAME PROPAGATION THROUGH AIRCRAFT VENT SYSTEMS Final Report
J. P. Gillis Aug. 1969 90 p
(Contract FA-67-WA-1704)
(NA-69-32) Avail: CFSTI

A study was made of flame propagation in a simulated aircraft vent system to provide design criteria for future vent system installations in aircraft. Determinations were made of flame speeds in various sections of the vent system under conditions of ascent, descent and aircraft-on-ground. Temperature and altitude effect on flame speed were also investigated. The geometric configuration of the simulated vent system caused momentary flame speeds in excess of 1000 feet per second and the associated pressures developed in some instances exceeded the structural limitations of typical aircraft vent ducts. Conclusions indicate methods of reducing flame propagation speed in aircraft vent systems. Author

N69-35869# Politecnico di Torino (Italy). Istituto di Macchine e Motori per Aeromobili.
FLAME STABILIZATION IN CAN-TYPE COMBUSTORS [LA STABILIZZAZIONE DELLA COMBUSTIONE NFI TUBI DI FLAMMA]

P. Campanaro Mar. 1967 27 p refs In ITALIAN; ENGLISH summary
(Contract CNR-115-0375-200)
(Publ-67) Avail: CFSTI

The most suitable theoretical and experimental results on the flame stabilization in can-type combustors are examined. The available stability correlations offer evidence of a compromise between the reaction kinetic rate and mixing criteria. Two fundamental ways of proceeding are suggested: analysis relating the data with the chemical air loading group, balanced by Re; theory of turbulent burning velocity, taking into account the influence of Re on the flame speed. Some doubts remain about the restrictions that heat and pressure losses impose on the selected combustion model. Author (ESRO)

N69-35896 Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

HEAT TRANSFER IN SMOOTH TUBES, BETWEEN PARALLEL PLATES, ALONG A FLAT PLATE, IN ANNULAR SPACES AND ALONG TUBE BUNDLES FOR EXPONENTIAL DISTRIBUTION OF THE HEAT FLUX IN FORCED, LAMINAR OR TURBULENT FLOW [TRANSFERT DE CHALEUR DANS DES TUBES LISSES, ENTRE DES PLAQUES PLANES PARALLELES, LE LONG D'UNE PLAQUE PLANE, DANS DES ESPACES ANNULAIRES ET LE LONG DE FAISCEAUX TUBULAIRES POUR UNE REPARTITION EXPONENTIELLE DU FLUX DE CHALEUR EN ECOULEMENT FORCE, LAMINAIRE OU TURBULENT]

Hans Gräber (Ph.D. Thesis--Paris Univ., 28 Jun. 1968) Apr. 1969 280 p refs In FRENCH; ENGLISH summary
(CEA-R-3600; EUR-3880-f) Avail: CFSTI

By introducing an additional parameter F_p, the processes known hitherto for calculating heat transfer are extended to the heat flux distributions following an exponential law $q_w = \exp(mx)$ which give a heat transfer coefficient independent of position for laminar and turbulent flow with a linear pressure drop. For laminar flow along a semi-infinite plate, the heat flux distribution in accordance with the law $q_w = x^m$ leads to the Nusselt number, regardless of the position. Nu is then determined by the thickness of the thermal boundary layer. For the annular space, the equations for explicit calculation of the temperature field will be given, as well as the Nusselt number in laminar flow and constant heat flux. In turbulent flow, the laws of distribution of eddy diffusivity for momentum in a tube, established by H. Reichardt, adapted for the annular space and the tube bundle, give the velocity field and the coefficient of friction and thus permit solution of the heat transfer equations. The results of the numerical calculation are given in the tables and diagrams for an extended range of the various parameters and compared with the experimental results. A simple process to determine the lower limit of the thermal entry length is described. Author (ESRO)

N69-35949*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

EVALUATION OF AN INFRARED HEATING SIMULATION OF A MACH 4.63 FLIGHT ON AN X-15 HORIZONTAL STABILIZER

Rodger A. Fields and Andrew Vano Washington Sep. 1969 35 p refs
(NASA-TN-D-5403) Avail: CFSTI CSCL 20M

Temperatures recorded on the X-15 horizontal stabilizer during a Mach 4.63 flight were simulated in the laboratory. A liquid-nitrogen evaporative cooler was used to cool the structure to a prelaunch condition; the heating was provided by an infrared heating system with closed-loop control. The simulated flight produced temperatures from approximately -05° F (228° K) to 750° F (672° K). The simulation was evaluated by comparing flight-measured temperatures with those measured during the simulation. Author

N69-35967# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EFFECT OF STABILIZER GEOMETRY AND FLOW VELOCITY ON VIBRATION COMBUSTION

S. A. Abrukov Mar. 1969 9 p refs Transl. into ENGLISH from Tr. Tsentr. Nauch.-Issled i Proyektno-Konstrukt. Kotloturbinnyy Inst. (Leningrad), no. 64, 1965 p 46-48
(AD-687632; FTD-HT-23-1107-68) Avail: CFSTI CSCL 21/2

Preliminary experimental data are given on the effect which stabilizer geometry has on vibration combustion at low flow velocities. The experiments were done on an installation with a combustion chamber in the form of a quartz tube 1 meter in length with one end inserted into a metal container. Holes in this container were used for fuel and air supply and for mounting the pressure gauge and stabilizer rod. The stabilizers tested were conical and axially symmetric. The quartz combustion tube was held in the vertical position with the metal container at the lower end. A mixture of propane and air in a constant ratio of 1:21 was used as the fuel. A piezoelectric barium titanate pickup was for registration of oscillations in pressure. The signals from this pickup were sent through a VZ-4 amplifier to a 2KO-1 oscillograph. Graphs were plotted for indices of vibration combustion as a function of stabilizer paramaters at a given flow velocity. It was found that when the engagement factor is fairly high (0.8-0.9) the acoustic properties of the system are determined only by that section of the tube which contains the products of combustion from the edge of the stabilizer to the upper cone of the tube. The author concludes that experiments showed the basic dependence of flame height on vibration frequency and the existence conditions of vibration combustion are most favorable if the contact period equals 0.76-0.87 and the flow velocities are great enough. Author (TAB)

N69-35969# Ballistic Research Labs., Aberdeen Proving Ground, Md.

MICROSCOPIC THEORY OF DETONATION IN SOLIDS

C. E. Melton, D. F. Stranzwilk, and P. D. Yedinak Apr. 1969 25 p refs
(AD-688869; BRL-TN-1715) Avail: CFSTI CSCL 19/1

A detonation theory based on a microscopic model of a solid has been developed. This was accomplished by considering known physical and chemical properties of the individual molecules in the system. The results show that molecular vibrational energies, normal lattice frequencies and activation energies are the most important parameters in the model. Molecules having low vibrational energies are easier to detonate, according to the theory, because of the ease of creation of a population inversion or hot spot in the system. A perfect crystal would be more difficult to detonate because initiation would occur at one of the faces. However, the model shows that perfect crystals of unstable solids cannot be grown. Consequently, detonation in any real crystal will be initiated in the interior near a defect. The present model explains many experimental observations that cannot be explained on the basis of older theories of detonation. For example, the microscopic theory can easily explain the occurrence of explosions during growth of crystals from solutions. Author (TAB)

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N69-34683# Bosch (Robert) G.m.b.H., Stuttgart (West Germany).
TECHNICAL REPORTS, VOLUME 2, NUMBER 4 [TECHNISCHE BERICHTE, BAND 2, HEFT 4]
Jun. 1968 49 p refs In GERMAN; ENGLISH summaries
Avail: CFSTI

CONTENTS:

1. INVESTIGATIONS OF THE SULFATE DISTRIBUTION IN LEAD ACCUMULATOR PLATES BY MEANS OF RADIOACTIVE SULFUR ISOTOPE S^{35} Hermann Laibsle, Harald Reber, Werner Herrmann, and Ernst Zehender p 159–163 refs (See N69-34654 20-06)

2. FREQUENCY AND TEMPERATURE INFLUENCE ON VIBRATIONAL ENERGY LOSSES IN PLASTICS Adolf Mandel p 164–169 refs (See N69-34655 20-18)

N69-34657# Bosch (Robert) G.m.b.H., Stuttgart (West Germany). Entwicklung Fertigungstechnik.
VALUE ENGINEERING AS A BASIS OF METHODICAL PRODUCT DEVELOPMENT [WERTGESTALTUNG ALS GRUNDLAGE METHODISCHER ERZEUGNISENTWICKLUNG]
Paul Baier *In its* Tech. Rept., Vol. 2, No. 4 Jun. 1968 p 177–183 refs In GERMAN; ENGLISH summary (See N69-34653 20-34)
Avail: CFSTI

In developing a new product it is necessary to reconcile quality, profitability and modernity. This can be achieved by close co-operation between experts in all the areas involved. A plan exists, which is characterized by an outstanding combination of system and organization and which forms the foundation for realistic and successful team-work. The method, in the report, is known as 'value engineering'. ESRO

N69-34658# Bosch (Robert) G.m.b.H., Stuttgart (West Germany). Entwicklung Fertigungstechnik.
A SPECIAL CASE OF NETWORK PLANNING IN PRODUCTION PLANNING [EIN SONDERFALL DER NETZPLANTECHNIK IN DER FERTIGUNGSVORBEREITUNG]
Erich Knapp, Manfred Schauss, and Edgar Weckerle *In its* Tech. Rept., Vol. 2, No. 4 Jun. 1968 p 184–192 refs In GERMAN; ENGLISH summary Prepared jointly with R. Bosch Electron. und Photokino(See N69-34653 20-34)
Avail: CFSTI

The application of critical path methods to a special case of production planning is described. General PERT methods have been adapted to design a planning network from three components: standard network plans, components lists and time estimates for activities. The program was written in Fortran and no manual drafting of network plans was required. ESRO

N69-34688# Bosch (Robert) G.m.b.H., Stuttgart (West Germany).
TECHNICAL REPORTS, VOLUME 2, NUMBER 5 [TECHNISCHE BERICHTE, BAND 2, HEFT 5]
Nov. 1968 57 p refs In GERMAN; ENGLISH summaries
Avail: CFSTI

CONTENTS:

1. DEVELOPMENT OF BATTERIES FOR AUTOMOBILES WITH ELECTRIC PROPULSION Hermann Dietz p 211–219 refs (See N69-34689 20-03)

2. PLASMA-SPRAYED ELECTRICALLY INSULATING CERAMIC COATINGS Kuno Kirner p 220–226 refs (See N69-34690 20-18)

3. SINTERING PROCESS AND RADIAL RUPTURE STRENGTH OF Fe/Sn AND Fe/Cu/Sn SINTERED SPECIMENS F. Esper, K.-H. Friese, and R. Zeller p 227–244 refs (See N69-34691 20-17)

4. MONITORING AND CONTROL OF VAPOR DEPOSITION PROCESSES BY MEANS OF QUARTZ CRYSTAL VIBRATORS Klaus Berger and Arno Illenberger p 245–252 refs (See N69-34692 20-14)

5. TEMPERATURE EFFECTS IN THICKNESS MEASUREMENTS OF EVAPORATED FILMS BY MEANS OF QUARTZ VIBRATORS Karl Kerner p 253–256 refs (See N69-34693 20-14)

6. CAPACITIVE MEASUREMENT OF THIN QUARTZ PROTECTIVE COATINGS ON ALUMINUM REFLECTORS Heinrich Knapp p 257–260 refs (See N69-34694 20-14)

N69-34695# Bosch (Robert) G.m.b.H., Stuttgart (West Germany).
TECHNICAL REPORTS, VOLUME 2, No. 6 [TECHNISCHE BERICHTE, BAND 2, HEFT 6]
Dec. 1968 45 p refs In GERMAN; ENGLISH summaries
Avail: CFSTI

CONTENTS:

1. QUANTITATIVE MICROANALYTIC DETERMINATION OF RUTHENIUM, PLATINUM, AND ALUMINUM IN ALLOYS AND SOLID SOLUTIONS P. Scharner and D. Baresel p 263–267 refs (See N69-34696 20-06)

2. ELECTRON EMISSION MICROSCOPY H. Dueker p 268–278 refs (See N69-34697 20-14)

3. A CONTRIBUTION TO THE DESIGN, PRODUCTION AND APPLICATION OF FORM-PRESSED PARTS OF METAL POWDERS Johannes Kreissig p 170–176 refs (See N69-34656 20-17)

4. VALUE ENGINEERING AS A BASIS OF METHODICAL PRODUCT DEVELOPMENT Paul Baier p 177–183 refs (See N69-34657 20-34)

5. A SPECIAL CASE OF NETWORK PLANNING IN PRODUCTION PLANNING Erich Knapp, Manfred Schauss, and Edgar Weckerle p 184–192 refs (See N69-34658 20-34)

N69-34917*# National Aeronautics and Space Administration, Washington, D.C.
THE SYSTEMS APPROACH TO MANAGEMENT. AN ANNOTATED BIBLIOGRAPHY, WITH INDEXES
Jul. 1969 69 p refs
(NASA-SP-7501) Avail: CFSTI CSCL 05B

The announcements of the systems approach to management appear by accession number and are grouped under the following categories: the systems concept, recent developments, specific functions, multi-national organization, manpower management, public administration, impact on management, and practical applications. F.O.S.

N69-35015# HRB-Singer, Inc., State College, Pa.
IMPLICATIONS OF BESRL RESEARCH FOR DISPLAYS IN TACTICAL INFORMATION PROCESSING
James M. McKendry, Douglas J. Mace, and James D. Baker Jan. 1969 34 p refs
(Contract DAHC19-68-C-0006)
(AD-688581; BESRL-TRR-1156) Avail: CFSTI CSCL 15/4

The purpose of the report is two-fold: first, to examine the potential impact of past and on-going human performance research on operational problems in assimilating information from situation displays in the field; second, to identify operational problem areas involving preparation and use of situation displays which could profit from detailed human performance research. During field operations, military staff officers maintain a representation of the tactical situation of both friendly and enemy forces. The staff element primarily concerned with the friendly force situation is the operations element (G3); the intelligence element (G2) focuses on the enemy situation. With the staffs of both elements, assimilation of information from situation displays is an important part of the job. Author (TAB)

N69-35061# Technische Univ., Berlin (West Germany). Institut fuer Raumfahrttechnik.
ALTERNATIVES FOR THE FUTURE OF TECHNOLOGY [ALTERNATIVEN FUER DIE ZUKUNFT DER TECHNIK]
H. H. Koelle 15 May 1969 27 p refs In GERMAN Presented at the VDI-Jahresver Sammlung Brunswick, 1969
(TUB-IR-1969/6; DCA-013) Avail: CFSTI

The problems and future of technology are discussed in relationship to the structure of society as such. Development alternatives constitute: (1) dominant technology; (2) random technology; (3) humane technology; (4)subservient technology; and (5) neglected technology. The author concludes that the most attractive development is a technology subservient to public goals; all large industries should maintain a branch for advanced research. Transl. by G.G.

N69-35072# Technische Univ., Berlin (West Germany).
RESOURCES PROGNOSES BASED ON REGRESSION ANALYSIS [RESSOURCENPROGNOSEN AUF DER BASIS DER REGRESSIONSANALYSE]
Guenter W. Tumm Mar. 1969 37 p refs In GERMAN; ENGLISH summary
(TUB-IR-1969/2) Avail: CFSTI

A model for the long-range projection of resources is developed based on a limited number of model criteria. The relevant types of models and statistical methods are discussed with respect to their prerequisites. To determine the quantitative relationship between dependent and independent variables in one structural equation regression analysis is used. The isolated projections of the dependent variable are combined into an unweighted and a weighted general projection with a statistical spread. For the weighted general projection a linear weighting function is developed which takes into account one-sided casualities in the variables. Furthermore, a computer program is described which was developed for the estimation of one independent structural equation using regression analysis and the estimation of isolated and general projections based on an independent model. Author

N69-35093# Naval Research Lab., Washington, D.C.
NAVAL RESEARCH LABORATORY PROGRESS
Feb. 1969 44 p refs
(PB-183245) Avail: CFSTI CSCL 05B

Contents: Analysis of radiation damage in silicon by thermal annealing of solar cells; Equilibrium concentration of impurity-vacancy complexes; Acoustics; Chemistry; Electronics; Metallurgy; Ocean sciences; Ocean tehcnology; Optical physics; Radar; and Solid state physics. USGRDR

N69-35130# Naval Research Lab., Washington, D.C.
NAVAL RESEARCH LABORATORY PROGRESS
Mar. 1969 27 p refs
(PB-183247) Avail: CFSTI CSCL 05B

Contents: Damage-model analysis of neutron embrittlement in steels; Atmosphere and astrophysics; Communications sciences; Metallurgy; Ocean technology; and Solid state physics. USGRDR

N69-35150*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
LEGAL TREATMENT OF EXTRATERRESTRIAL MATTER [TRATAMIENTO LEGAL DE LA MATERIA EXTRATERRESTRE]
Aldo Armando Cocca Washington NASA Aug. 1969 7 p refs Transl. into ENGLISH from Spanish
(Contract NASw-1692)
(NASA-TT-F-12458) Avail: CFSTI CSCL 05D

The legal status of meteorites is discussed. It is thought that the claims of science and humanity as a whole should prevail over interests of personal property and national sovereignty. Author

N69-35152*# Oklahoma State Univ., Stillwater. College of Engineering.
A PILOT PROGRAM FOR SELECTING, EDITING, AND DISSEMINATING ENGINEERING AND SCIENTIFIC EDUCATIONAL SUBJECT MATTER FROM NASA TECHNICAL REPORTS Quarterly Report, 1 Mar.–31 May 1969
31 May 1969 66 p
(Contract NSR-37-002-045)
(NASA-CR-103949; ER-69-1-4) Avail: CFSTI CSCL 05B

The preparation, dissemination, and evaluation of instructional monographs are discussed, and statistics of dissemination of university and industrial monographs are included. The comments of consultants are reported, and resumes of the consultants are presented. F.O.S.

N69-35287# National Physical Lab., Teddington (England). Hovercraft Unit.
TECHNO-ECONOMIC ASPECTS OF HOVERCRAFT
M. S. Iggleseden Jan. 1969 45 p Presented at UN Seminar on Tech. Econ. and Operational Aspects of Inland Water-Borne Transport, Leningrad, 7–29 Sep. 1968
(NPL-Hovercraft-6) Copyright. Avail: CFSTI

The paper sets out to give a clear picture of the present position in development of British hovercraft today, and to state their capabilities over water and in amphibious operation. The operating costs are examined, both to identify the origins of the charges and to indicate where differences might occur due to developments and to local financial climates. Possible developments are described, which could be applied to present designs or to new designs aimed at particular operating conditions. Author (ESRO)

N69-35524*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
SPACE PROGRAMS SUMMARY NO. 37-57, VOLUME II FOR THE PERIOD 1 MARCH–30 APRIL 1969. THE DEEP SPACE NETWORK
31 May 1969 184 p refs
(Contract NAS7-100)
(NASA-CR-105313; JPL-SPS-37-57-Vol-2) Copyright. Avail: CFSTI CSCL 22A

Operation and instrumentation for the deep space network are described. The network supports planetary and interplanetary flight projects by simultaneously performing advanced engineering on components and systems, integrating equipment and methods into the network, and supporting each project through that project's

tracking and data system. Basic functions described constitute: (1) tracking and position determination of spacecraft; (2) data acquisition from the spacecraft through telemetered engineering measurements and scientific data; and (3) sending coded signals to spacecraft for equipment activation and to initiate spacecraft functions. G.G.

N69-35574# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.
THE FUTURE ENERGY SUPPLY OF THE WORLD
B. Lehnert Apr. 1969 7 p refs
(Repr-69-11) Avail: CFSTI

The available data and energy consumption predictions indicate that conventional energy supplies will become insufficient during the first half of the next century and this crisis can only be avoided by the use of nuclear sources. The transition to nuclear power is discussed and it is shown that research and development of breeder and/or fusion reactors should be intensified. ESRO

N69-35747# Congress. Senate. Committee on Aeronautical and Space Sciences.
NASA AUTHORIZATION FOR FISCAL YEAR 1970, PART 1
Washington GPO 1969 459 p Hearings before Comm. on Aeron. and Space Sci., 91st Congr., 1st Sess., 28-30 Apr. 1969
Avail: Comm. on Aeron. and Space Sci.

Testimony is presented in support of NASA's overall budget request, the long-range objectives of the agency, and the funding for research and program management. The successes in manned space flight programs are discussed in detail, along with the planning for manned orbital space stations, advanced manned missions, and the Apollo Applications Program basic objectives and mission concepts. Consideration is also given to the future direction of the space program to further implement the objectives set forth in the National Aeronautics and Space Act of 1958. M.G.J.

N69-35748# Congress. Senate. Committee and on Aeronautical and Space Sciences.
NASA AUTHORIZATION FOR FISCAL YEAR 1970, PART 2
Washington GPO 1969 998 p Hearings before Comm. on Aeron. and Space Sci., 91st Congr., 1st Sess., 1, 6, and 9 May 1969
Avail: Comm. on Aeron. and Space Sci.

Testimony centered on NASA's important programs in unmanned scientific satellites, planetary probes, and applications satellites, with particular reference to the Applications Technology Satellites, the Orbiting Astronomical Observatory, and the Nimbus weather satellite. Existing and future applications programs were described by witnesses from the Environmental Science Services Administration, the U. S. Geological Survey, and the Agricultural Research Service, with interest focused on their participation in the earth resources technology area. The aeronautics and space programs of the Atomic Energy Commission and the Department of Defense were also reviewed. M.G.J.

N69-35749# Forsvarets Forskningsanstalt, Stockholm (Sweden).
THE CAPABILITY TO SEE SOME TANK APPLICATIONS IN RECONNAISSANCE [MOEJLIGHETERNA ATT SE - NAGRA GRUNDTANKAR OM SPANING]
Einar Hassborn Oct. 1967 30 p In SWEDISH
(FOA-2-A-2506-52) Avail: CFSTI

This report refers initially to an article entitled "The See Capability" in the May 1966 issue of the U.S. periodical *Army*. The current stand of reconnaissance technology in tactical warfare is reviewed in the light of latest applications in the war in Vietnam. Reconnaissance methods and equipment are discussed, including target acquisition radar, counterfire radar, acoustic detectors and amplifiers, infrared devices for night reconnaissance, visual airborne target locators, aircraft-mounted panoramic cameras, and moving-target indicators. Some unorthodox techniques, such as air sampling (sniffing), xenon searchlights, laser distance measuring, and multisensor methods, are also discussed. The necessary coordination and evaluation information, supporting data processing, the vehicles required for transport, and training of personnel are mentioned. Transl. by K.W.

N69-35776# European Space Research Organization, Paris (France).
ESRO/ELDO BULLETIN NUMBER 5
May 1969 44 p partly in ENGLISH and partly in FRENCH Prepared jointly with ELDO
Avail: CFSTI

CONTENTS:

1. ESRO'S CURRENT AND FUTURE SATELLITE PROGRAMME p 4-9 (See N69-35777 20-31)
2. THE SELDO CONTRACTING SYSTEM AND ITS SPECIAL JURIDICAL ASPECTS J. de Reuse p 10-13 (See N69-35778 20-34)
3. PREPARATIONS FOR ESRO'S FUTURE SCIENTIFIC PROGRAMME p 14-18 (See N69-35779 20-30)
4. ELDO MINISTERIAL CONFERENCE, 15 APRIL 1969 p 19-30 (See N69-35780 20-34)
5. TECHNICAL PROGRAMME p 31-33 (See N69-35781 20-31)
6. PROGRESS IN OPERATIONAL PROGRAMME p 34-40 (See N69-35782 20-31)

N69-35778# European Space Vehicle Launcher Development Organization, Paris (France).
THE ELDO CONTRACTING SYSTEM AND ITS SPECIAL JURIDICAL ASPECTS [LE REGIME DES CONTRATS DU CECLES/ELDO ET SES ASPECTS JURIDIQUES PARTICULIERS]
J. de Reuse *In its* ESRO/ELDO Bull. No. 5 May 1969 p 10-13 In French (See N69-35776 20-34)
Avail: CFSTI

This report describes the special ELDO contracting system which comprises either direct contracts with industry or indirect ones through ELDO Member States. The juridical problems arising from this twofold policy are also discussed. ESRO

N69-35780# European Space Vehicle Launcher Development Organization, Paris (France).
ELDO MINISTERIAL CONFERENCE, 15 APRIL 1969 [CONFERENCE DES MINISTRES DU CECLES, 15 AVRIL 1969]
In its ESRO/ELDO Bull. No. 5 May 1969 p 19-30 In ENGLISH and FRENCH (See N69-35776 20-34)
Avail: CFSTI

This report presents resolutions made at the Ministerial Conference of Member States of the European Space Vehicle Launcher Development Organization held in Paris on 15th April 1969 concerning future activities of the organization. ESRO

N69-35834*# Battelle Memorial Inst., Columbus, Ohio.
SELECTED SPACE GOALS AND OBJECTIVES AND THEIR RELATION TO NATIONAL GOALS

PUBLIC COLLECTIONS OF NASA DOCUMENTS

G. E. Wukelic and N. A. Frazier 15 Jul. 1969 117 p refs
(Contract NASw-1146)
(NASA-CR-105304; BMI-NLVP-TR-69-2) Avail: CFSTI CSCL 22A

This study is designed to improve the rationale used in long-range planning of space transportation systems. The overall effort is based on the premise that meaningful relationships exist between national goals and priorities, and space goals and objectives. In turn, these relations can provide the basis for formulating a methodology for defining and analyzing rational future mission models required for national space transportation systems planning. Funding allocations to the national goals provide a yardstick for measuring priorities among the goals. These quantified relationships are indicators of the nation's willingness to commit funds for translating broad philosophical statements of national purpose into accomplishments. As such, these relationships may then be condidered into accomplishments. As such, these relationships may than be considered to be meaningful measure of response to desires and purposes of the nation. A working set of space goals and objectives were identified and between them and the set of 13 national goals were determined. Author

N69-35976# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Porz (West Germany).
DVL NEWS, NUMBER 39 [DVL NACHRICHTEN, HEFT 39]
Mar. 1969 35 p In GERMAN
Avail: CFSTI

CONTENTS:

1. FUELS FOR FLIGHT SPEEDS UP TO MACH 3.5 Günter Spengler and Robert Erlmeier p 439-442 (See N69-35977 20-27)
2. SAILPLANE RESEARCH AND DESIGN IN GERMANY Hans Zacher p 443-445 (See N69-35978 20-02)
3. ACOUSTO-OPTICAL DEFLECTION OF LASER PULSES Friedrich Malota p 446-447 (See N69-35979 20-16)
4. A PLANE PLATE IN LOW DENSITY HYPERSONIC FLOW Manfred Becker p 448-449 (See N69-35980 20-01)
5. THREE DIMENSIONAL SUPERSONIC FLOW ABOUT FINITE SPAN WINGS Anneliese Frohn and Yi-Chuin Sun p 450-453 (See N69-35981 20-01)
6. UNIVERSAL DATA PROCESSING SYSTEM FOR TELEMETRY SIGNAL Wolfgang Papke p 454-456 (See N69-35982 20-07)
7. PROGRESS REPORT ON AZUR SATELLITE Martin Schurer p 457-458 (See N69-35983 20-31)
8. PIEZOELECTRIC VARIOMETER FOR THE MEASUREMENT OF TIME PRESSURE GRADIENTS IN GASEOUS OR LIQUID MEDIA Bernd Korndörfer p 458-460 (See N69-35984 20-14)
9. PROGRESS IN THE DEVELOPMENT OF HIGH-ENERGY LITHERGOLIC PROPULSION SYSTEMS Roger Lo p 460-461 (See N69-35985 20-28)

N69-35986*# Syracuse Univ., N.Y.
THE APOLLO PROJECT MANAGER, ANOMALIES AND AMBIGUITIES
David L. Wilemon and John P. Cicero Jun. 1969 20 p refs
(Grant NGL-33-022-090)
(NASA-CR-105282) Avail: CFSTI CSCL 05A

This article deals with some of the problems that Apollo project managers face in the everyday operation and implementation of the manned space effort. The emphasis is on the focal position of the project manager rather than on an overall systems concept of project management. Five areas of anomalies and ambiguities in terms of problem resolution and management strategies are discussed: (1) maintaining the balance between technical and managerial emphasis; (2) risk acceptance/rejection; (3) surviving environmental restraints; (4) the significance of project communication; and (5) penetrating organizational boundaries. Discussion of these areas gives some preliminary insights into the management styles of the effective project managers and opens significant areas for future research on the management of large-scale, complex undertakings such as Apollo. Author

N69-35993*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
THE MAIN SOURCES OF SPACE LAW [DIE HAUPTQUELLEN DES WELTRAUMRECHTS]
M. von Rauchhaupt Washington NASA Aug. 1969 8 p ref Transl. into ENGLISH from the German
(Contract NASw-1692)
(NASA-TT-F-12459) Avail: CFSTI CSCL 05D

An overview is presented on the inception and growth of space law. The scientific bases of space exploration and space law are discussed in the context of the three layers of the atmosphere and the lower boundary of space. It is pointed out that no fixed system of space law has yet developed, and that each topic is being considered individually by various international groups. The theoretical aspects of space law are defined as divine law, modern rational law, and self-governing of technological ventures. The practical impact of each aspect is examined. D.L.G.

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